Australian Government
Department of the Environment and Energy

Australia's Fourth Biennial Report

December 2019

Cover image: Blue Gums beside cattle pool in Mount Augustus National Park © Nick Rains

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Foreword

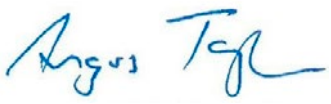
Australia continues to take effective and practical action as part of a coordinated global effort to address climate change. Approaching 2020, we continue to strengthen our domestic policy framework and our international partnerships to reduce emissions and build resilience. We are currently on track to overachieve on our 2020 target, which is a reduction of five per cent below 2000 levels by 2020 and are projected to meet our commitments under the Paris Agreement.

The Climate Solutions Fund continues the success of the Government's centrepiece emissions reduction policy. Since its introduction in 2015, the Emissions Reduction Fund has contracted over 190 Mt of abatement, of which over 44 Mt has already been delivered. Strong growth in renewable investment means Australia will exceed its Large-Scale Renewable Energy Target in 2020. Since the National Energy Productivity Plan was introduced in 2015, energy productivity in Australia has increased by nearly three per cent.

As of 30 June 2019, Australia's Clean Energy Finance Corporation, the world's most successful green bank, has made cumulative investment commitments of $7.2 billion to projects worth over $24 billion. Each dollar invested by the Corporation leveraged $2.20 in private sector investment. The Australian Renewable Energy Agency has provided $1.4 billion in grant funding to renewable energy projects with a total value of more than $5.49 billion focusing on research and development for energy innovation, security and reliability.

Australia provided $274 million in international climate assistance in 2016–17 and $324 million in 2017–18. This funding contributed to our commitment announced in 2015 to provide at least $1 billion over five years (2015–16 to 2019–20) to help developing countries in our region build climate resilience and reduce emissions. We prioritise assistance to countries most vulnerable to climate change, with two thirds of climate finance benefitting small-island developing states and least developed countries. Australia established the Asia-Pacific Rainforest Partnership and the International Blue Carbon Partnership, and works closely with the governments of Thailand, Indonesia and countries in the Pacific on several bilateral programs purposed to assist countries with their emissions measurement and monitoring and management of forest and blue carbon ecosystems.

In February 2019, the Australian Government announced the Climate Solutions Package, a $3.5 billion investment which maps out how we will achieve the abatement needed to meet our 2030 Paris target. The Climate Solutions Package builds on existing mitigation actions such as the Emissions Reduction Fund, the Renewable Energy Target, and the National Energy Productivity Plan, and also funds the development of a National Electric Vehicle Strategy, and investment in Snowy 2.0 and other electricity infrastructure to support the transition to clean energy in Australia.



THE HON ANGUS TAYLOR MP
Minister for Energy and Emissions Reductions

SENATOR THE HON MARISE PAYNE
Minister for Foreign Affairs

THE HON SUSSAN LEY MP
Minister for the Environment

1. Executive summary

Australia's Fourth Biennial Report summarises Australia's progress towards meeting its 2020 target under the United National Framework Convention on Climate Change (UNFCCC).

Chapter 2 of this report provides an overview of Australian greenhouse gas emissions and trends as well as a description of Australia's National Inventory System including institutional arrangements and quality control and assurance processes. In 2018, Australia's emissions per capita (21.5 t CO_2-e per person) and the emissions intensity of its economy (0.29 kg CO_2-e per dollar) were at their lowest levels since 1990. Australia's total net emissions have declined by 11.6 per cent over the 1990–2017 period. Emissions from Land Use, Land Use Change and Forestry (LULUCF) have also decreased by the largest margin of any sector over this period. Emissions from the waste and agriculture sectors also decreased since 1990, while emissions from the energy, industrial processes and product use sectors increased over the same period.

Australia is on track to meet, and overachieve, on its 2020 target, an economy-wide emissions reduction of five per cent below 2000 levels by 2020. Details on this target are provided in Chapter 3.

Australia has a comprehensive suite of policies to reduce greenhouse gas emissions, increase energy efficiency and fast track the development and uptake of clean energy. Policies that have contributed to meeting our 2020 target include the Emissions Reduction Fund, the Renewable Energy Target and a suite of energy efficiency measures. The Government has legislated the phase-down imports of hydrofluorocarbons (HFCs). The ambitious phase down – 85 per cent by 2036 – is ahead of the global response agreed under the Montreal Protocol.

Clean energy innovation continues to be driven by research, development and demonstration grants provided by the Australian Renewable Energy Agency (ARENA), while concessional finance for emerging technologies and businesses is provided by the Clean Energy Finance Corporation (CEFC) through its Clean Energy Innovation Fund. The CEFC also provides financing on more commercial terms to support the broader deployment of more established clean energy technologies. The Government has announced an intention to establish a new $1 billion Grid Reliability Fund that would be administered by the CEFC. This would support investment in new energy generation, storage, transmission infrastructure and grid stabilising technologies. By August 2019, enough large-scale renewable capacity had been built to meet Australia's Large-Scale Renewable Energy Target in 2020. Around a third of Australia's electricity needs are expected to be met with renewables in the early 2020s. These are just a few of the successes detailed in Chapter 4, which outlines Australia's policies to reduce emissions and meet its international commitments.

Projections of future emissions, discussed in Chapter 5, show that Australia's cumulative abatement task for the 2030 target has fallen compared to previous projections. This a result of successful mitigation actions and the Australian economy becoming less emissions intensive.

Internationally, Australia assists developing countries to address their specific climate change challenges. This includes finance, capacity building and technology transfer to help countries achieve low-carbon, sustainable and resilient economic development. Chapter 6 of this report details Australia's international action on climate change.

Australia's institutional arrangements and policy reviews undertaken since the last reporting period are discussed in Chapter 7.

This report addresses recommendations made by the UNFCCC Expert Review Team during its assessment of Australia's Seventh National Communication and third Biennial Report. This includes the clarification of reporting on state, territory and local government mitigation actions and their impact on the national emissions reduction targets in Chapter 4. A summary of the outcomes of reviews of climate change policies and measures undertaken since Australia's Seventh National Communication and Third Biennial Report is included in Chapter 7.

2. Information on greenhouse gas emissions and trends

In 2018 Australia's emissions per capita (21.5 t CO_2-e per person) and the emissions intensity of its economy (0.29 kg CO_2-e per dollar) were at their lowest levels since 1990. Over the period 1990–2017, on a United National Framework Convention on Climate Change (UNFCCC) accounting basis, energy-related emissions (stationary energy, transport and fugitives emissions from fuels) dominated Australia's emissions profile. The energy sector experienced the greatest increase in emissions, largely driven by the expansion of Australia's LNG export industry, followed by emissions from the industrial processes and product use sector. Emissions from Land Use, Land Use Change and Forestry (LULUCF) have decreased by the largest margin of any sector over the 1990–2017 period, with emissions from waste and agriculture also falling over the same period.

Australia is committed to the continuous improvement of its national greenhouse gas inventory. Emission estimates are prepared using best available data and an integrated inventory system. Estimates are subject to extensive and mature quality assurance and control processes to ensure they meet the UNFCCC quality criteria of transparency, time series consistency, accuracy, completeness and comparability.

Since the Seventh National Communication and third Biennial Report, Australia has developed a range of measures to improve its national greenhouse gas inventory system and emissions estimates – these measures include the adoption of new data and methods, new source/sink categories and strengthening of quality assurance and control processes.

Unless otherwise stated, the greenhouse gas data in this report are consistent with Australia's *National Inventory Report 2017* (NIR 2019), submitted under the UNFCCC and the Kyoto Protocol (KP) in May 2019. In addition to the *National Inventory Report*, Australia publishes a range of supporting emissions estimates that provide further information on Australia's emissions on a regional and industry basis. Together, these products constitute the Australian National Greenhouse Accounts.

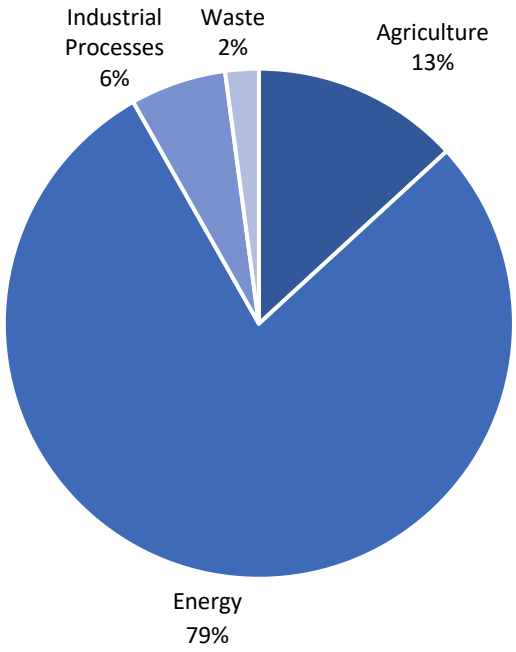
2.1 Overview of national emissions

Emission Profile

In 2017 Australia's total greenhouse gas emissions including the LULUCF sector were 534.7 Mt carbon dioxide equivalent (CO_2-e) under the UNFCCC accounting framework. Australia's net greenhouse gas emissions excluding LULUCF were 554.1 Mt CO_2-e in 2017.

Energy-related emissions (stationary energy, transport and fugitive emissions from fuels) dominate Australia's emissions profile, contributing 78.6 per cent of total emissions in 2017 excluding LULUCF, while the agriculture sector contributes 13.2 per cent (see Figure 2.1). Emissions from the industrial processes and product use (6.1 per cent) and waste (2.1 per cent) sectors are relatively minor. LULUCF sector emissions and removals were a net sink of 19.4 Mt CO_2-e in 2017.

Figure 2.1 Australia's emissions profile 2017 (a)



Source: Australian Department of the Environment and Energy

(a) The LULUCF sector was a net sink of 19.4 Mt CO_2-e in 2017

Emission trends

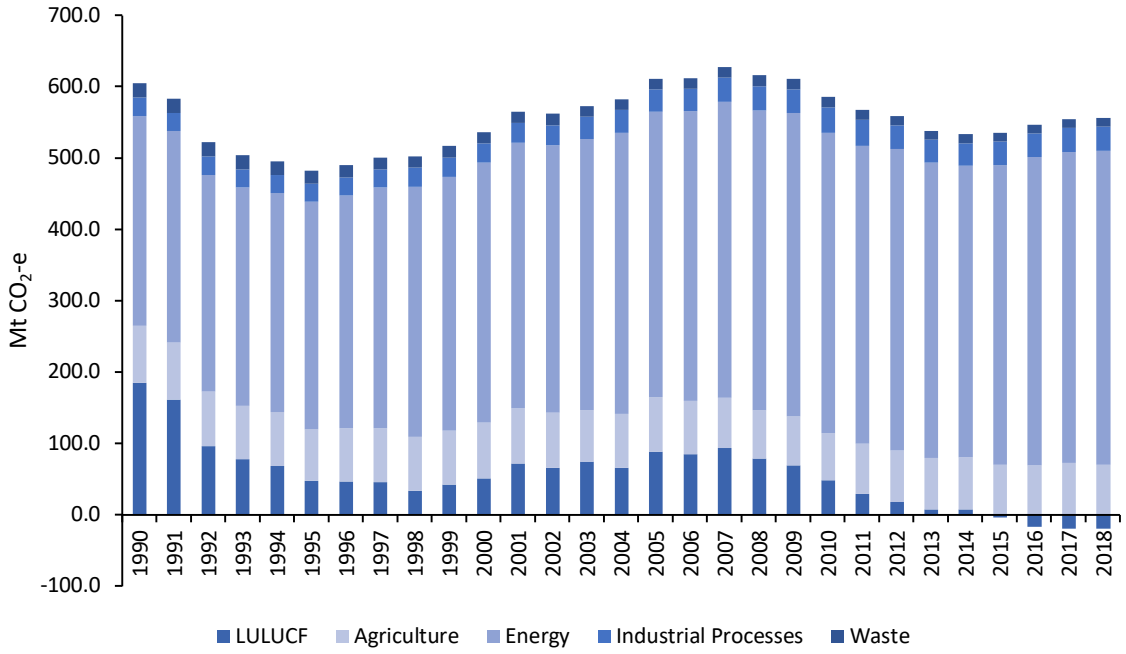
As shown in Table 2.1 and Figure 2.2, the largest increase in emissions over 1990 to 2017 was from energy (48.2 per cent increase, 141.6 Mt CO_2-e increase), which comprises stationary energy (45.9 per cent increase, 89.7 Mt CO_2-e increase), transport (60.8 per cent increase, 37.3 Mt CO_2-e increase), and fugitive emissions from fuels (39.2 per cent increase, 14.6 Mt CO_2-e increase). In recent years, increases in emissions are largely driven by the expansion of Australia's LNG exports industry. Since 2013, six new LNG projects have come online adding around 55 Mt of annual nameplate capacity. Industrial processes and product use emissions increased by 29.4 per cent, or 7.7 Mt CO_2-e. Emissions declined in agriculture (9.0 per cent decrease, 7.2 Mt CO_2-e decrease), waste (41.1 per cent decrease, 8.2 Mt CO_2-e decrease) and LULUCF (110.5 per cent decrease, 204.0 Mt CO_2-e decrease).

Table 2.1 Australia's net greenhouse gas emissions by sector (UNFCCC Inventory)(a)

Sector and Subsector	Emissions Mt CO_2-e			Per cent change
	1990	2016	2017	1990–2017
1. *Energy (combustion + fugitive)*	294.0	432.1	435.6	48.2
Electricity	129.6	194.7	189.8	46.5
Stationary energy excluding electricity	65.8	92.3	95.3	44.8
Transport	61.4	96.4	98.7	60.8
Fugitive emissions from fuel	37.2	48.7	51.8	39.2
2. *Industrial processes and product use*	26.0	33.0	33.7	29.4
3. *Agriculture*	80.2	69.3	73.0	-9.0
4. *Land use, land use change and forestry (LULUCF)*	184.6	–16.3	–19.4	–110.5
5. *Waste*	20.0	12.4	11.8	–41.1
Total net emissions (including LULUCF) (a)	**604.9**	**530.4**	**534.7**	**–11.6**

Please note, these figures have been rounded to one decimal place.
(a) The LULUCF sector was a net sink of 19.4 Mt CO_2-e in 2017

Figure 2.2 Australia's net greenhouse gas emissions by sector (UNFCCC inventory)(a)



Source: Australian Department of the Environment and Energy
(a) Includes preliminary emissions estimates for 2018

The principal drivers of these emission trends were electricity, fugitive emissions, transport, industrial processes and product use, agriculture, waste and LULUCF. The contributions of the principal drivers to emissions trends are as follows:

Electricity

The electricity sector has experienced the largest growth of all sectors, increasing by 60.2 Mt CO_2-e since 1990.

Electricity emissions grew strongly between 1990 and 2008, largely due to increasing population and economic growth, which at that stage was highly calibrated to electricity demand.

Between 2009 and 2018 electricity generation emissions decreased by 30.2 Mt CO_2-e (14.3 per cent) from the peak in 2008–09 despite continuing population and economic growth. This was primarily driven by an 8.0 per cent increase in the share of generation of renewable energy in the National Electricity Market, with the largest increases coming from wind and solar, and a 1.8 per cent increase in the share from natural gas. This has coincided with a 9.8 per cent decrease in the share of electricity generation from brown and black coal, following the closure of twelve coal fired power plants between 2012 and 2017.

Fugitive emissions

Until 2016, coal mine fugitives were the largest contributor to national fugitive emissions. An increase in liquefied natural gas (LNG) production since 2013 means that fugitive emissions from oil and gas are now the largest contributor to national fugitive emissions.

The emission intensity of fugitive emissions from coal mining has halved since 1990. This has been driven by increased surface mining, and shift in the share of underground mine production away from high gas coal fields.

Since 2012, the adoption of flaring of coal mine methane and technologies to recover and utilise coal mine waste gas for electricity generation has been increasingly adopted in underground mining.

Improvements in natural gas distribution networks and the switching of oil and gas production from venting to flaring drove the decline in oil and gas fugitive emissions between 1990 and 2008.

Since 2013, six new LNG projects have come online adding around 55 Mt of annual nameplate capacity. This has resulted in a doubling of LNG production since 2013, driving a strong increase in total oil and gas fugitive emissions.

Transport

Emissions from transport have increased 60.8 per cent or 37.3 Mt CO_2-e since 1990, driven by the increase in diesel consumption, due to continuing growth in the number of diesel passenger and heavy vehicles, and also an increase in air travel.

Over the last two years, there has been a marked increase in a switch from petrol to diesel, reflecting continued growth in the sales of diesel powered four-wheel drives. This reflects consumer preferences, with six out of 10 top selling cars in May 2019 being diesel powered four-wheel drives.

Industrial processes and product use

The emissions in the industrial processes and product use sector have increased by 29.4 per cent since 1990. The increase is primarily driven by the growth in hydrofluorocarbons (HFCs) used in refrigeration and air-conditioning equipment, as they replace ozone depleting chemicals phased out by the Montreal Protocol

Increased HFC emissions over the period from refrigeration and air conditioning were partly offset by declining emissions in other activities.

Improvements in abatement technology in nitric acid production led to a decrease in emissions from 2011 to 2017. Emissions from aluminium production fell between 2016 and 2017 due to a decrease in production levels and consumption of associated inputs. Since 1990 emissions per tonne of aluminium produced declined by 29.3 per cent due to improvements in process controls and equipment upgrades.

Agriculture

The decrease in net agricultural emissions of 9.0 per cent since 1990. Climate (droughts, recovery from droughts, large seasonal differences and rainfall) as well as economic forces such as national and international markets, directly impact emissions from the agricultural sector.

The 9.0 per cent decline is primarily associated with a decline in sheep numbers. From 1995 to 2002 emissions increased due to increased beef cattle numbers and increased emissions from agricultural soils. From 2002 until 2010 emissions declined due to prolonged and widespread drought conditions over southern and eastern Australia which contributed to reductions in animal populations, crop production, fertiliser use, and associated emissions. Australia saw wetter conditions from 2011 to 2017 with emissions increasing driven by high levels of crop production. Livestock populations also increased over this period.

Waste

Emissions from the waste sector have decreased by 41.1 per cent, as increases in waste generation associated with growing populations and industrial production have been offset by increased methane recovery. The majority of emissions were from solid waste disposal (70 per cent), which has experienced a substantial improvement in methane recovery rates over the period (from a negligible amount in 1990 to 8.3 Mt CO_2-e in 2017).

LULUCF

The decrease in emissions from LULUCF since 1990 has been mainly driven by the decline in emissions from land clearing (forest land converted to cropland and grassland), forest cover expansion (including post-1990 plantation establishment), and declines in the harvesting of native forests.

See the Common Tabular Format (CTF) Tables 1.1–1.5 in appendix 1 for details of Australia's emissions by sector.

Emissions by greenhouse gas type

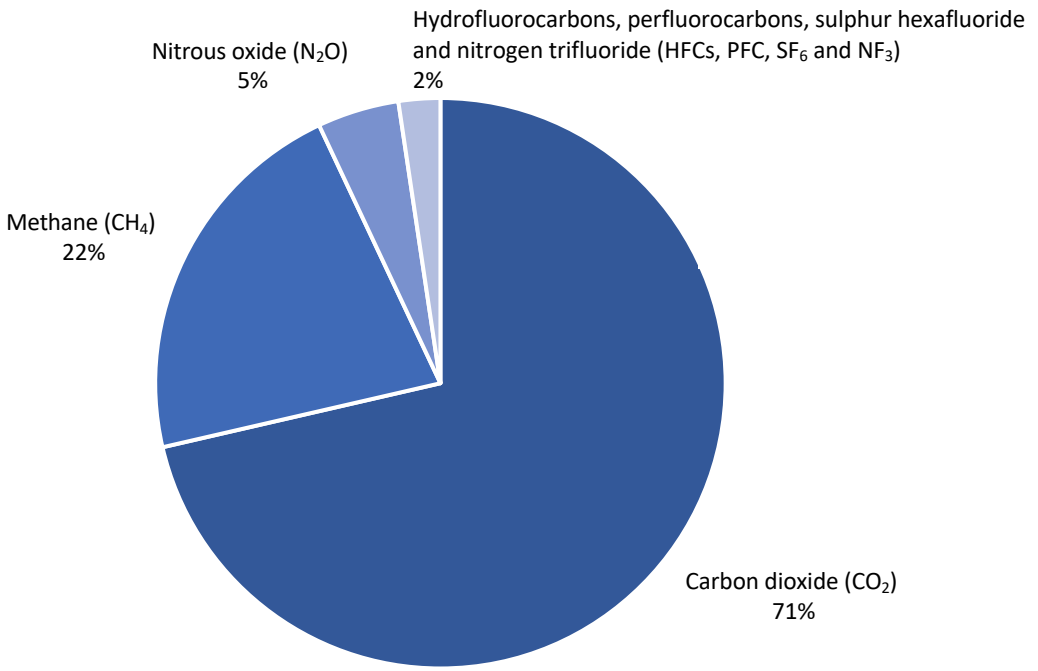
In 2017, carbon dioxide accounted for 71.4 per cent of Australia's total emissions (including LULUCF), followed by methane (21.6 per cent) and nitrous oxide (4.6 per cent) (Table 2.2 and Figure 2.3). Other greenhouse gases made up the remaining 2.4 per cent of Australia's inventory.

Table 2.2 Australia's net greenhouse gas emissions by gas type (UNFCCC Inventory)

	1990		2017		Change
Greenhouse gas	**Mt CO_2-e**	**per cent of total**	**Mt CO_2-e**	**per cent of total**	**Mt CO_2-e**
Carbon dioxide (CO_2)	443.95	73.39%	381.75	71.40%	–62.19
Methane (CH_4)	134.84	22.29%	115.53	21.61%	–19.31
Nitrous oxide (N_2O)	19.87	3.28%	24.78	4.63%	4.91
Hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride (HFCs, PFC, SF_6 and NF_3)	6.25	1.03%	12.63	2.36%	6.38
Total CO_2-e emissions	**604.90**		**534.70**		**–70.21**

Please note, these figures have been rounded to two decimal places.

Figure 2.3 Australia's net greenhouse gas emissions by gas type



Source: Australian Department of the Environment and Energy

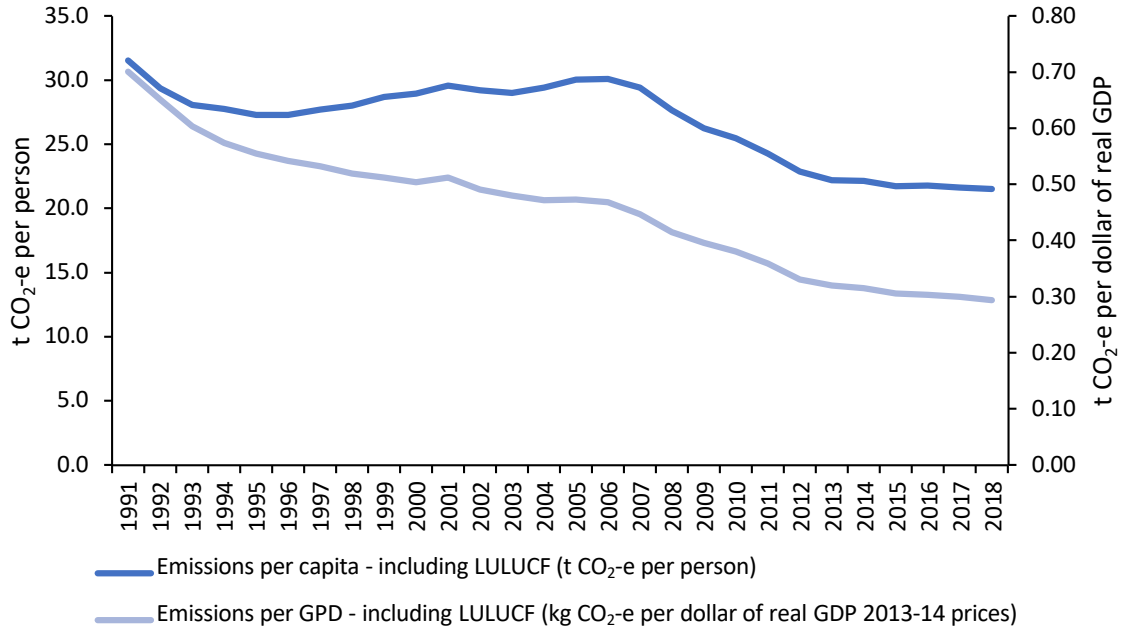
Australia's emissions per capita and emissions intensity

In 2018 Australia's emissions per capita were at their lowest levels since 1990 (see Figure 2.4). These declines have resulted from specific emissions management actions across sectors, the large decline in LULUCF emissions over the period, and structural changes in the economy.

Australia's population grew strongly between 1990 and 2018, from 17.1 million in 1990 to around 25.0 million in 2018 (growth of 45.6 per cent). Emissions per capita in 2018 were 21.5 t CO_2-e per person, compared to 33.5 t CO_2-e in 1990, representing a 35.8 per cent decline.

Australia's real Gross Domestic Product (GDP) also grew over this period, from $782 billion in 1990 to over $1,815 billion in 2018 (growth of 131.7 per cent). For 2018, emissions intensity (including emissions from LULUCF) was 0.29 kg CO_2-e per dollar of real GDP, compared to 0.73 kg CO_2-e per dollar of real GDP in 1990, representing a 59.8 per cent decline (Figure 2.4).

Figure 2.4 Australia's emissions per capita and emissions intensity, 1990–2018



Source: Australian Department of the Environment and Energy

2.2 National Inventory System

In accordance with the guidelines for national systems (decision 19/CMP.1 annex paragraph 12(a) and decision 3/CMP.11), the Australian Department of the Environment and Energy is responsible for all aspects of the National Inventory compilation under the Australian Administrative Arrangements Order. This includes activity data coordination, emission estimation, quality control, improvement planning, preparation of reports, and submission of reports to the UNFCCC on behalf of the Australian Government.

Since the third Biennial Report, there has been no change in administrative arrangements. Responsibility for the National Inventory remains with the Australian Department of the Environment and Energy.

Coverage

Australia's inventory covers sources of greenhouse gas emissions, and removals by sinks, resulting from human (anthropogenic) activities, grouped under the five sectors identified by the IPCC:

- energy (including stationary energy, transport and fugitive emissions from fuels)
- agriculture
- industrial processes and product use
- land use, land use change and forestry (LULUCF)
- waste.

The inventory covers the major greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

Indirect greenhouse gases covered in ancillary fashion for reporting under the UNFCCC are: carbon monoxide (CO), oxides of nitrogen (NO_x), and non-methane volatile organic compounds (NMVOCs). Sulphur dioxide (SO_2), an aerosol precursor, is included because emissions of this gas influence global warming.

Geographical coverage of the Australian inventory includes the six states (Queensland, New South Wales, South Australia, Tasmania, Victoria and Western Australia), mainland territories (Australian Capital Territory, Jervis Bay Territory and Northern Territory), associated coastal islands, and external territories (Ashmore and Cartier Islands, Christmas Island, Cocos Islands, Coral Sea Islands, Heard and McDonald Islands and Norfolk Island). Australia's Antarctic Program operations in the Antarctic are also covered.

Data sources

Data collection to support the preparation of Australia's inventory is managed centrally by the Department of the Environment and Energy using a mix of approaches to ensure the reliable flow of data from other entities to support inventory preparation. The National Greenhouse and Energy Reporting System (NGERS) is the primary data source for energy, industrial processes and product use and waste sector emissions estimates. This data may be supplemented by other national data sources when required. A summary of Australia's principal data sources and their relationship to inventory compilation can be found in Figure 2.5.

The National Greenhouse and Energy Reporting System (NGERS)

Energy, industrial processes and product use and waste sector emissions estimates are informed by data collected under the NGERS. Reporting is mandatory for all facilities with emissions above 25,000 tonnes CO_2-e per year or energy consumed or produced above a certain limit. Every major company in Australia must estimate and report relevant activity data, ensuring consistency in data collection for these sectors.

The Australian Department of the Environment and Energy has policy and legislative oversight of the NGER. The Clean Energy Regulator (CER) manages the process of input data collection from companies, data verification/auditing and the dissemination of this data to government agencies. The CER's Emissions and Energy Reporting System is used for the collection of the data. Annual reports have been submitted by companies under the NGERS for Australian financial years since 2008–09.

The rules for the estimation of activity data, emission factors and emissions by companies are well defined and set out in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (the Determination).

The National Greenhouse Accounts Framework estimation methodologies, used by the Australian, state and territory governments, industry, company and facility level inventories, ensure consistency. These estimation methodologies are consistent with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 2006 guidelines). Integration and consistency of the estimation methods and data is critical for ensuring changes in emissions at the facility level are captured efficiently and accurately in the national inventory. The default methods used by companies are derived from the national inventory methods while the default emission factors have been derived using the Australian Greenhouse Emissions Information System (AGEIS).

Since the third Biennial Report, key amendments to the NGER legislation have included:

- Updates to the Determination to improve the estimation of emissions from legacy waste at landfills, carbon capture and storage (CCS) activities and decommissioned underground coal mines.
- Amendments to the *NGER (Audit) Determination 2009* to enhance quality of audits by ensuring consistency across audit practices and providing auditors with structure and guidance when conducting audits.

As part of Australia's commitment to continuously improve its national inventory, the Determination is reviewed annually by the Department of the Environment and Energy. The reviews seek to ensure the NGER system aligns with Australia's international reporting obligations, and to identify options to improve the consistency, cost effectiveness and accuracy of the methods available to estimate emissions. Proposed amendments to the Determination are subject to public consultation.

In 2018 the independent Climate Change Authority reviewed the NGER Act and its supporting legislative instruments. It concluded that the legislation is 'operating well, is meeting its objectives and is generally fit for purpose'.

The NGER Act and its subordinate legislation are available at: www.cleanenergyregulator.gov.au. Further information on the NGER Act review can be found in chapter 7.1.

Other data sources

The NGER system data sources may be supplemented by national data sources if required (shown in Figure 2.5). The data collected and published by the Australian Bureau of Statistics (ABS), the legislated national statistical agency, and the Department of the Environment and Energy are the primary sources of supplementary data for Australian emissions estimates.

The ABS, in conjunction with the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), is the major source of activity data for the agriculture sector.

The Department of the Environment and Energy employs consultants to process satellite imagery used to determine land cover change for the LULUCF sector. Satellite imagery is sourced from Geosciences Australia (Australia's principal satellite ground station and data processing facility).

Data to support estimates of HFCs are sourced from compulsory reporting by importers under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 2003*. Data from the Commonwealth Scientific and Industrial Research Organisation's Cape Grim monitoring station is used to calibrate the annual leakage rate of synthetic greenhouse gases with atmospheric observations.

Solid waste disposal data are collected annually as part of the National Waste Reporting initiative and sourced within the Department of the Environment and Energy.

Since the third Biennial Report, the responsibility for the compilation of the Australian Energy Statistics (AES) has moved from the Department of Industry, Innovation and Science to the Department of the Environment and Energy. The AES estimates Australian energy consumption by fuel and economic sector for the purpose of meeting Australia's reporting commitments to the International Energy Agency, and supplements NGER system data sources for estimates in the energy sector.

Estimation methods

The Australian methodology for estimating greenhouse gas emissions and sinks uses country-specific and IPCC methodologies and emission factors consistent with the IPCC 2006 guidelines and the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (IPCC 2014 revised methods).

In general, Australia's national inventory uses a mix of tier two and tier three estimation methods incorporating:

- facility-specific emission estimation processes
- characterisations of the capital and technology types at the point of emission
- dynamic relationships linking current emissions outcomes with the activity levels of previous years
- spatial differences in emissions processes across Australia.

The additional complexity in the methodology allows emissions to be estimated more accurately. The full description of the methodologies used by Australia in emissions estimation is provided in the most recent *National Inventory Report*.

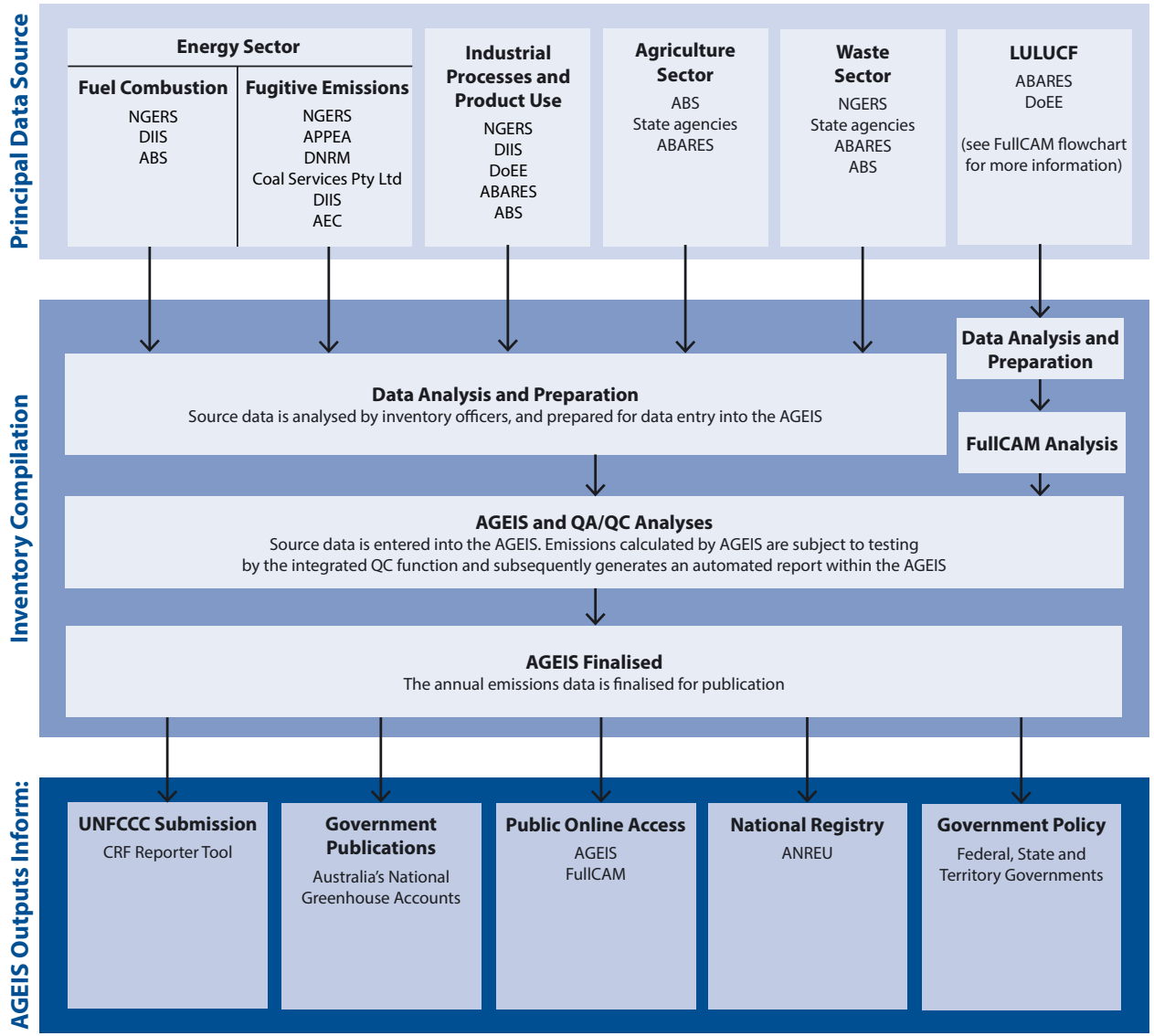
Supporting inventory systems

Estimation of emissions is conducted utilising two key Information Technology assets: AGEIS and for the LULUCF sector, Full Carbon Accounting Model (FullCAM) (see Figure 2.5).

Figure 2.5 Department of the Environment and Energy inventory asset structures and relationships

Acronym Key

ABARES	Australian Bureau of Agricultural Resource Economics and Sciences
ABS	Australian Bureau of Statistics
AEC	Australian Energy Council
AGEIS	Australian Greenhouse Emissions Information System
ANREU	Australian National Registry of Emissions Units
APPEA	Australian Petroleum Production and Exploration Association
BoM	Bureau of Meteorology
CER	Clean Energy Regulator
CRC	Cooperative Research Centres
CRF	Common Reporting Format
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DoEE	Department of the Environment and Energy
DIIS	Department of Industry, Innovation and Science
DNRM	Department of Natural Resources and Mining (Queensland)
FullCAM	Full Carbon Accounting Model
NGERS	National Greenhouse and Energy Reporting Scheme
QA	Quality Assurance
QC	Quality Control



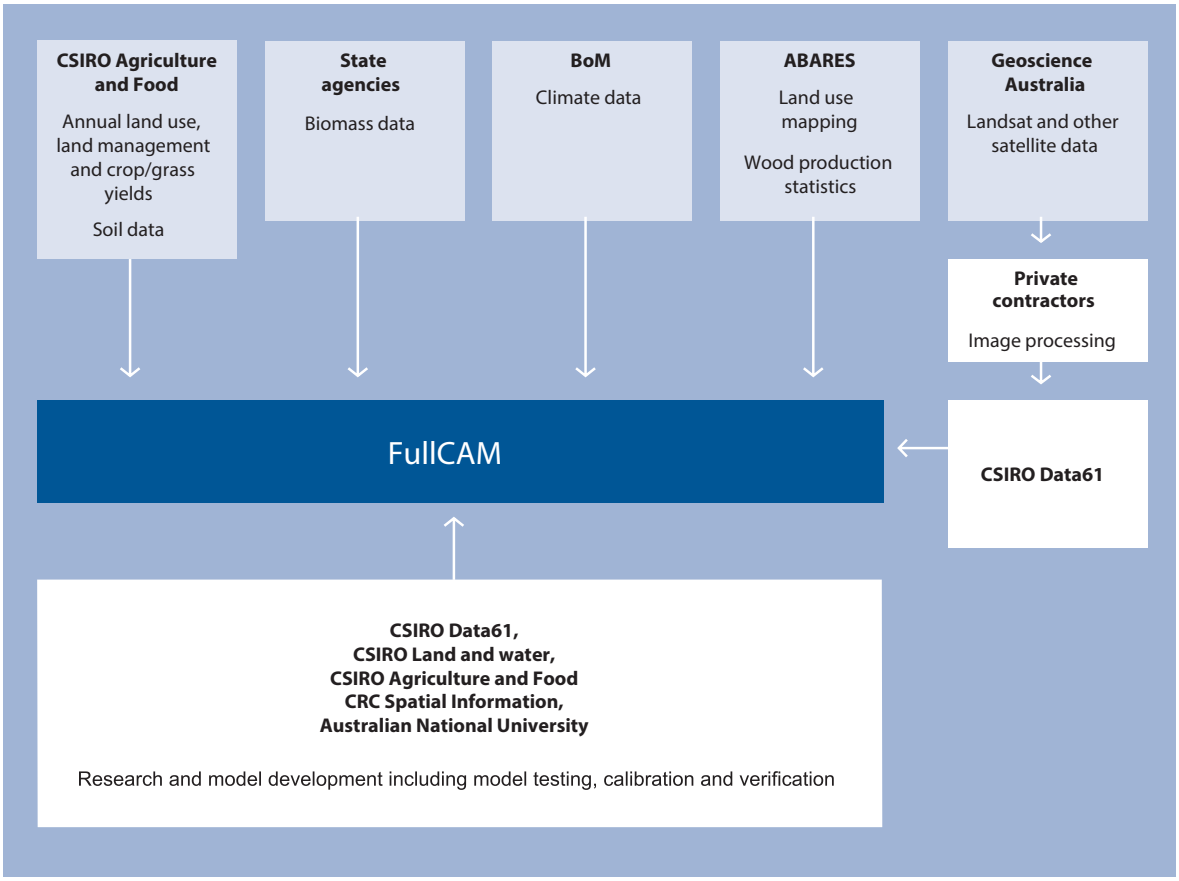
Source: Australian Department of the Environment and Energy

The AGEIS was designed to meet the requirements for national inventory systems and is an integral part of the inventory preparation and publishing processes. The AGEIS software incorporates the emissions estimation methods used for the national inventory. In addition, it fully integrates quality control procedures and centralises emissions estimation, inventory compilation and reporting, and data storage activities. The AGEIS supports high transparency levels for Australia's National Greenhouse Accounts, with emissions data publicly accessible through a dynamic web interface.

The AGEIS continues to be expanded and refined. Recent investment in the asset addresses the integration and automation of quality control systems, which will strengthen quality assurance and the automatic population of data reported through the updated Common Reporting Format Reporter software.

While the AGEIS is used for final preparation of Australia's National Greenhouse Accounts, FullCAM prepares estimates of emissions and removals from the LULUCF sector and Kyoto Protocol LULUCF activities. FullCAM is used to support emissions estimates and has been substantially redeveloped to improve its capability to model ecosystems. This was achieved by applying techniques described in the IPCC 2014 revised methods and with the addition of updated national datasets. To date, the modelling capability has been completed for conversion of forests to other land uses (e.g. cropping and grazing), conversion of lands to forest, croplands remaining croplands, cropland management, and the grassland component of remaining grasslands and grazing land management, and biomass burning. Further information on data sources underpinning FullCAM can be found in Figure 2.6.

Figure 2.6 FullCAM institutional arrangements



Source: Australian Department of the Environment and Energy

The Department of the Environment and Energy staff and external consultants have extensive experience in inventory preparation. The Department of the Environment and Energy aims to maximise the number of staff trained as UNFCCC reviewers to participate in UNFCCC Expert Review processes. All senior technical staff are qualified reviewers and have been accepted onto the UNFCCC Roster of Experts. Where particular technical expertise is not available within the Department of the Environment and Energy, expert consultants are engaged to undertake analysis and review work in accordance with the principles of the Australian Government's procurement guidelines.

Process for national consideration and approval of the inventory

The National Greenhouse Gas Inventory Committee, which comprises representatives of the Australian, state and territory governments, considers Australia's draft *National Inventory Report*. Key domestic users of national inventory data are engaged in the formal review arrangements through the National Inventory Users Reference Group (NURG). This group includes Australia's premier science organisation, academics, sectoral experts and industry representatives. The NURG meets once or twice per year.

The National Greenhouse Gas Inventory Committee and the NURG are the principal mechanisms for formal external review of the Report prior to its release. The release of each year's inventory and submission to the UNFCCC is approved by the Deputy Secretary of the Department of the Environment and Energy.

Quality assurance and quality control

Australia's national inventory is subject to mature and extensive quality assurance (QA) and quality control (QC) processes. These measures conform to IPCC Guidelines and Supplementary Methodologies.

QA and QC processes for Australia's national inventory systems are outlined in the *National Inventory Systems: Quality assurance-quality control plan* and summarised in Australia's NIR 2019. These processes contribute to the production of accurate inventories. Uncertainties are reduced to the extent practicable, and estimates are transparent, documented and consistent over time, complete and internationally comparable.

Australia's key QC measures have been systematically built into the operation of AGEIS. Auditable checks are undertaken to reduce the risks of errors associated with activity data input, missing data, recalculations and the time series consistency of generated emission estimates. Input data and implied emission factors are checked for recalculations and time series consistency prior to submission using AGEIS and the Common Reporting Format reporter tool.

Systems have been established to monitor the outcomes of QA and QC risk mitigation strategies and control measures, principally managed through the AGEIS. Each year, evaluation of data collected under the monitoring systems is undertaken and documented in *the National Inventory Systems: Evaluation of Outcomes*. Following consideration of this document, improvements to the inventory are made through *the National Inventory Systems: Inventory Improvement Plan*.

In 2016–2017, these systems were subject to independent review in the context of a performance audit of the national inventory by the Australian National Audit Office (ANAO). The ANAO's objective was to assess the effectiveness of arrangements for the preparation and reporting of Australia's greenhouse gas emissions estimates in the *National Inventory Report 2014* (revised) for the year 2014. The ANAO report found that appropriate quality assurance and control procedures are in place for inventory data processing, emissions calculations and reporting. Further information on the audit can be found in chapter 7.2.

Notwithstanding the ANAO's findings, additional QA and QC activities and procedures have been implemented since the third Biennial Report, as identified in Australia's NIR 2019. These activities and procedures strengthen Australia's quality assurance and control processing. They include:

- new functionalities introduced into the AGEIS to achieve efficiencies in the QC process
- mitigating the risk of transcription errors during QC activity checks
- centralising all QC activities for review and archiving
- improving the QC programs within FullCAM.

Recalculation of previously submitted inventory data

Inventory estimates are periodically recalculated. This occurs for a number of reasons including updated UNFCCC reporting guidelines, revisions in key external data sources and revisions to data due to refinements in the estimate methodology or the inclusion of additional sources. Recalculation of emissions estimates from previous years are used to ensure the accuracy of the estimates, and to maintain consistency of the time series. These recalculations are conducted in accordance with the IPCC 2006 guidelines.

Since the third Biennial Report, Australia has:

- Compiled more accurate and comprehensive emissions estimates following the refinement of existing and adoption of new data, methods and source/sink categories.
- Implemented significant recalculations in the LULUCF sector, the oil and gas fugitives sector and in the estimation of emissions of fluorinated gases. The adoption of advanced methods, estimation and calibration techniques have greatly increased the level of confidence in the sectors' emissions estimates.
- Included seagrasses under the wetlands land use category in LULUCF for the first time in the *National Inventory Report 2016* as part of its progressive implementation of the voluntary 2013 Wetlands Supplement. The seagrass sub-category reports emissions arising from the excavation of seagrass habitat due to capital dredging for port construction or expansion.

3. Australia's 2020 Target (Quantified Economy-wide Emissions Reduction Target)

The Australian Government is committed to a Quantified Economy-wide Emissions Reduction Target (QEERT) of five per cent below 2000 levels by 2020 (Australia's 2020 target) under the United Nations Framework Convention on Climate Change (see CTF Table 2(a)). Australia is on track to meet and overachieve its 2020 target as assessed against the emissions budget (Table 4.1, chapter 4).

In addition to its 2020 target, Australia also has a second commitment period (CP2) target under the Kyoto Protocol (KP) and a 2030 target under the Paris Agreement.

Australia reports progress towards its CP2 target through its annual *National Inventory Report* in accordance with decision 1/CMP.8 and supplementary reporting requirements under Article 7 of the Kyoto Protocol.

Under the Paris Agreement, Australia has committed to an economy-wide emissions reduction target of 26 to 28 per cent below 2005 levels by 2030. This is to be developed into an emissions budget covering the period 2021–2030.

Australia's emissions reduction targets are supported by a comprehensive suite of policies to reduce greenhouse gas emissions, increase energy efficiency and fast track the development and uptake of clean energy. These policies cover every sector of the economy (see chapter 4 for further information).

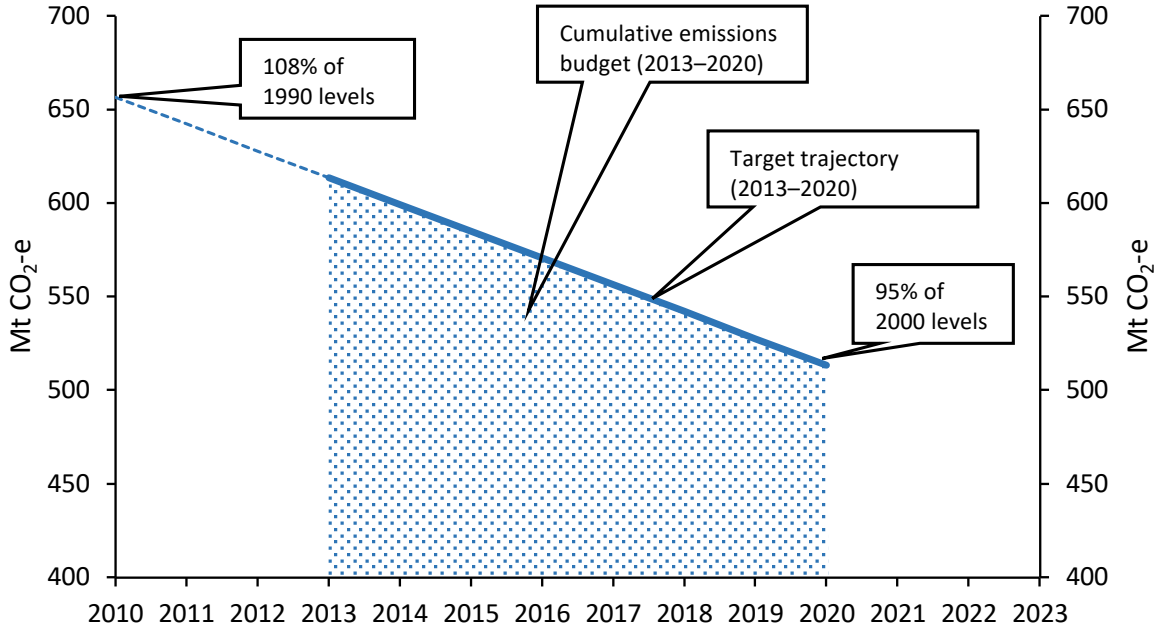
Australia's 2020, CP2 and 2030 targets build on the successful achievement of our first commitment period target under the Kyoto Protocol. They also demonstrate Australia's commitment to setting and achieving successive, progressively more ambitious, economy-wide emissions reduction targets.

3.1 Details of Australia's 2020 target

Australia will reduce its economy-wide emissions to five per cent below 2000 levels by 2020 (see CTF Table 2(a)). Australia's 2020 target takes the form of an emissions budget for the period 2013 to 2020. The current estimate of the emissions budget is 4,508 Mt CO_2-e. This value is subject to change based on recalculations of Australia's national greenhouse gas inventory.

As shown in Figure 3.1, the emissions budget for the 2020 target is calculated using a straight-line trajectory which takes a linear decrease from 2010 to 2020. This trajectory begins from Australia's previous target, the Kyoto Protocol CP1 target (108 per cent of 1990 levels), and finishes at five per cent below 2000 levels in 2020. The shaded area under the trajectory for the period 2013–2020 is the emissions budget for the 2020 target.

Figure 3.1 Australia's 2020 emissions reduction target



Source: Department of the Environment and Energy 2019

Australia's 2020 target is inclusive of all emissions and removals of greenhouse gases reported in its annual national inventory under the Kyoto Protocol. This includes the gases CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3; the energy, industrial processes and product use, agriculture and waste sectors and KP LULUCF sub-classifications (deforestation, afforestation, reforestation, forest management, cropland management, grazing land management and revegetation).

The global warming potentials (GWPs) used in the inventory are from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report prescribed in decision 24/CP.19 (see CTF Table 2(b)). Carbon dioxide equivalents (CO_2-e) of these gases are calculated using the GWP for a 100-year time horizon (see CTF Table 2(c)).

Australia's Kyoto Protocol inventory is submitted as supplementary information in its annual National Inventory Report (chapters ES.2.2 and 11).

3.2 Approach to tracking progress to the 2020 target

Australia assesses progress towards its 2020 target by comparing cumulative net emissions over the period 2013–2020 with the emissions budget for the period. Australia will meet the 2020 target when cumulative emissions over the period 2013–2020 total less than the emissions budget. This analysis utilises Kyoto Protocol inventory estimates, including for LULUCF sub-classifications, as indicated above and in previous Biennial Reports.

For each year of the 2013–2020 budget period, Australia's annual net emissions are the sum of emissions from the energy, industrial processes and product use, agriculture and waste sectors and net emissions from each of the KP LULUCF sub-classifications. Australia's approach to accounting for emissions and removals from the LULUCF sub-classifications is consistent with the approach taken for all other inventory sectors, as set out in CTF Table 2(d). Emissions and removals for each LULUCF sub-classification are estimated by applying methodologies and activity definitions (see section 4.8 for further information).

4. Progress in achievement of Australia's Quantified Economy-wide Emissions Reduction Target

4.1 Overview

The Australian Government has a comprehensive suite of policies to meet its international greenhouse gas emissions reduction targets; increase energy efficiency and fast track the development and uptake of clean energy, including the Emissions Reduction Fund (ERF), the Safeguard Mechanism, the Renewable Energy Target (RET), and the COAG Energy Council led energy efficiency and productivity programs. The Government also supports the uptake of renewable energy and low emissions technologies through its funding support of the Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC).

The ERF has been the Government's centrepiece emissions reduction policy since 2015. To date, it has successfully contracted over 190 Mt of abatement, of which over 44 Mt has already been delivered. Contracted activities cover a range of sectors across the economy from landfill and waste, to agriculture, and energy efficiency. Through these activities, the ERF supports businesses, communities and farmers across Australia to try new practices and technologies that increase productivity, reduce greenhouse gases and combat climate change.

The Safeguard Mechanism places emissions limits (baselines) on facilities which emit more than 100,000 tonnes of carbon dioxide equivalent (Mt CO_2-e) each year. In 2017–2018 there were around 200 facilities covered by the mechanism, representing one quarter of Australia's emissions, including facilities in the mining, oil and gas, transport, manufacturing and waste sectors.

The RET is a legislated scheme designed to reduce greenhouse gas emissions in the electricity sector by encouraging additional generation of electricity from renewable sources. The RET is expected to lift the share of renewables to over 23 per cent of Australia's electricity in 2020. The Government announced in August 2019 that there are enough approved projects in the pipeline to meet the RET and that it will exceed it before the end of 2020.

Australia was a world leader in per capita clean energy investment in 2018. Installations of small-scale systems have exceeded expectations with over 3.3 million systems installed with help of the SRES. Australia has the world's highest level of uptake of household solar panels, with one in five Australian households now having solar panels on their roof (Bloomberg New Energy Finance 2019).

The Government has continued to support the uptake of renewable energy primarily through the Australian Renewable Energy Agency (ARENA), which provides grants for research development and demonstration projects, and the Clean Energy Finance Corporation (CEFC), whose mission is to increase the flow of finance into Australia's clean energy sector. These institutions have together invested over $8 billion into renewable and clean energy technology projects since 2015.

The COAG Energy Council agreed in December 2015 to a package of measures to improve Australia's Energy productivity by 40 per cent between 2015 and 2030. This package, known as the National Energy Productivity Plan (NEPP), takes a whole-of-system approach to energy policy and covers use and productivity efficiencies in electricity, gas and transport fuels. It includes energy market reforms to

promote consumer choice and increase competition and innovation in the energy market and energy efficiency measures, both new and existing, that support better energy use in building, equipment and vehicles. The NEPP is broadly on track to deliver on its target and is currently being reviewed. The review is scheduled to be delivered in 2020.

Looking forward, the Government is implementing the Climate Solutions Package announced in February 2019. The package includes a Climate Solutions Fund to continue purchasing low-cost abatement through the ERF, continued support for the transition to reliable renewable energy, development of a National Electric Vehicle Strategy and improvements to residential and commercial building energy efficiency. It will deliver over 200 Mt of abatement by 2030, contributing a significant portion of the abatement required to meet Australia's Paris Agreement target to reduce emissions by 26 to 28 per cent below 2005 levels by 2030. The Government anticipates that technology and other abatement will fully meet the target.

4.2 Greenhouse gas emissions in relation to the QEERT

To assess how Australia is tracking against its 2020 target, cumulative net emissions (actuals from 2013 to 2017 and projections from 2018 to 2020) are compared to the emissions budget. Cumulative emissions from 2013 to 2020 are projected to be 4,243 Mt CO_2-e, compared to the emissions budget of 4,508 Mt CO_2-e, indicating Australia will overachieve on its 2020 target. The table below includes updated inventory estimates for 2013-2017 as published in the June 2019 Quarterly Update of the National Greenhouse Gas Inventory to give the latest estimate of tracking against Australia's 2020 target.

Table 4.1 Net emissions associated with Australia's QEERT

KP Sector and Subsector	2000	2013	2014	2015	2016	2017	2018	2019	2020
	Emissions (Mt CO_2-e)								
1. Energy	364.3	414.3	409.0	419.0	429.6	433.6	434.2	437.4	435.5
2. Industrial processes and product use	26.7	31.5	31.7	33.1	33.0	33.7	34.5	34.7	35.0
3. Agriculture	78.4	72.1	72.6	70.1	69.3	73.0	71.6	67.4	67.3
4. LULUCF activities	55.4	7.4	7.1	-7.1	-16.8	-23.3	-24.5	-21.4	-17.4
5. Waste	15.7	12.4	12.5	11.9	12.4	11.8	11.8	11.8	11.7
Total net emissions (including LULUCF)	**540.4**	**537.7**	**532.9**	**527.0**	**527.4**	**528.8**	**527.6**	**529.9**	**532.0**

The summary estimates in Table 4.1, as per the latest *Quarterly Update of Australia's National Greenhouse Gas Inventory: June 2019*, and *Australia's emissions projections 2019* (Kyoto Protocol classifications) include emissions and removals from energy, industrial processes and product use, agriculture and waste sectors; and the following Kyoto Protocol LULUCF sub-classifications: deforestation, afforestation, reforestation, forest management, cropland management, grazing land management and revegetation.

Australia's mitigation policies and measures that have contributed to the reductions of greenhouse gases in these sectors are described in this section and in CTF Table 3.

4.3 Policy responsibility

Australia has a federal system consisting of three levels of government: Federal (the Australian Government), State and Territory (Queensland, New South Wales, South Australia, Tasmania, Victoria, Western Australia, the Australian Capital Territory and the Northern Territory) and local government bodies created by state and territory law.

The Federal Government is responsible for setting national emissions reduction targets, inventory and projections, whereas emissions reduction mitigation policies and measures can be developed and implemented by all levels of government.

All emissions reduction mitigation actions, whether nationally or sub-nationally led are captured in Australia's National Inventory accounts. For a list of mitigation actions led by States and Territories, refer to appendix 2.

Ministerial responsibilities are determined by the Prime Minister of Australia when deciding the makeup of the Cabinet through the issue of an Administered Arrangement Order (AAO). These responsibilities are subject to change. Ministerial and Departmental responsibilities outlined in this report are current as of 1 January 2020.

At the national level, the Australian Government develops its response to climate change and this is implemented by the Department of the Environment and Energy.

Responsibilities, for domestic climate change policy is shared between the Minister for Energy and Emissions Reductions and the Minister for the Environment.

The Minister for Energy and Emissions Reduction has policy responsibility for:

- Australia's greenhouse emissions and energy consumption reporting
- policy and legislation concerning Australia's domestic approaches to reducing emissions, including the ERF, Safeguard Mechanism, NEPP, RET, CEFC, and the ARENA.

The Minister for the Environment has responsibility for:

- climate change adaptation
- climate science, including the Intergovernmental Panel on Climate Change
- air Quality
- ozone and the phase-down of synthetic greenhouse gases
- International Blue Carbon Partnership
- Asia-Pacific Rainforest Partnership.

The Minister for Foreign Affairs had lead responsibility for Australia's international climate change policy, including UNFCCC negotiations and for overseeing Australia's aid program. The aid program includes international climate finance, capacity building and technology transfer. The Australian Government Department of Foreign Affairs and Trade advises in relation to this.

As recognised in the 2015 National Climate Resilience and Adaptation Strategy, climate change adaptation roles and responsibilities are differentiated between Australia's government jurisdictions of Commonwealth, State and Local government. In line with its responsibilities under the Strategy, the Commonwealth is working to provide national climate science information, and to manage climate and disaster risks in its policies, programs and assets.

Climate change adaptation policy is coordinated at the Commonwealth level through the Disaster and Climate Resilience Reference Group (the Group), which was established in 2015. The Group was established to support the Government's responsibilities as outlined in the *National Climate Resilience and Adaptation Strategy*; coordinate strategic direction for managing climate and disaster risks; and collaborate on matters related to improving Australia's resilience to climate change impacts and disasters.

Senior officials from all Australian Government departments and key science agencies meet quarterly through the Group. Under the Group's work program, CSIRO and the Department of the Environment and Energy developed a climate risk management framework for Commonwealth agencies called *Climate Compass*. This framework provides guidance on identifying and managing climate risks from a strategic through to operational level.

The Commonwealth also chairs the Adaptation Working Group, a forum for commonwealth, state and territory officials to discuss best practice approaches to adaptation and enable jurisdictions to collaborate and consult on priority matters of common interest in climate change adaptation.

State and territory governments have developed climate change policies for their jurisdictions, including long-term emissions reduction strategies, climate change adaptation strategies, renewable energy targets and policies for waste recovery and energy efficiency.

The Australian, state and territory governments maintain direct links between their departmental counterparts to share knowledge, resolve policy issues and collaborate on industry and community engagement. Ministerial discussions on climate change occur regularly through two forums: The Council of Australian Governments (COAG) Energy Council and the Meeting of Environment Ministers.

The Council of Australian Governments (COAG) Energy Council

The COAG Energy Council is a ministerial forum comprising ministers responsible for energy and resources matters for the Federal, State and Territory governments and New Zealand. The COAG Energy Council pursues reforms to ensure the ongoing reliability, security and affordability of Australia's energy markets, including ensuring renewable generation is incorporated into electricity markets effectively. This includes measures such as the NEPP and the National Hydrogen Strategy.

Meeting of Environment Ministers

The Meeting of Environment Ministers comprises the Australian Minister for the Environment and the Environment Minister from each Australian state and territory. These meetings provide a forum to discuss a range of strategic issues, including climate change, air quality and agreed cross-government actions to improve Australia's environment.

4.4 Mitigation actions and their effects

Australia has a proud record of implementing mitigation policies that ensure our emissions reduction targets are achieved. The aggregated effect of Australia's mitigation actions, from Australia's 2017 national inventory and projections from 2018 to 2020, demonstrate that the Government's actions are working and we are on track to overachieve on Australia's 2020 target.

The 2019 projections calculate the overachievement of the 2020 target will be approximately 411 Mt CO_2-e, inclusive of carry over. The 2019 projections are discussed in detail in Chapter 5 of this report.

CTF table 3 includes detail on mitigation actions and their effects towards achieving Australia's Quantified Economy-wide Emission Reduction Target.

4.5 Overview of mitigation policies and measures

Emissions Reduction Fund

The ERF was established as the Australian Government's emissions reduction policy centerpiece in 2015. The fund is a voluntary scheme that provides incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions. The Climate Solutions Fund announced in February 2019 provides an additional $2 billion in funding to continue the purchase of low-cost abatement through the Emissions Reduction Fund.

Crediting

The ERF allows businesses, community organisations, local councils, farmers and others to receive carbon credits by undertaking approved emissions reduction activities.

The Department of the Environment and Energy works with industry, research organisations, technical experts, and other Australian Government agencies to develop robust methods, underpinned by research and supported by industry. Methods are available for activities across all sectors in the economy, including agriculture and transport, flaring of coal mine waste gas, improving the energy efficiency of commercial buildings and industrial facilities, flaring landfill gas, reforesting and revegetating land, and managing savanna burning.

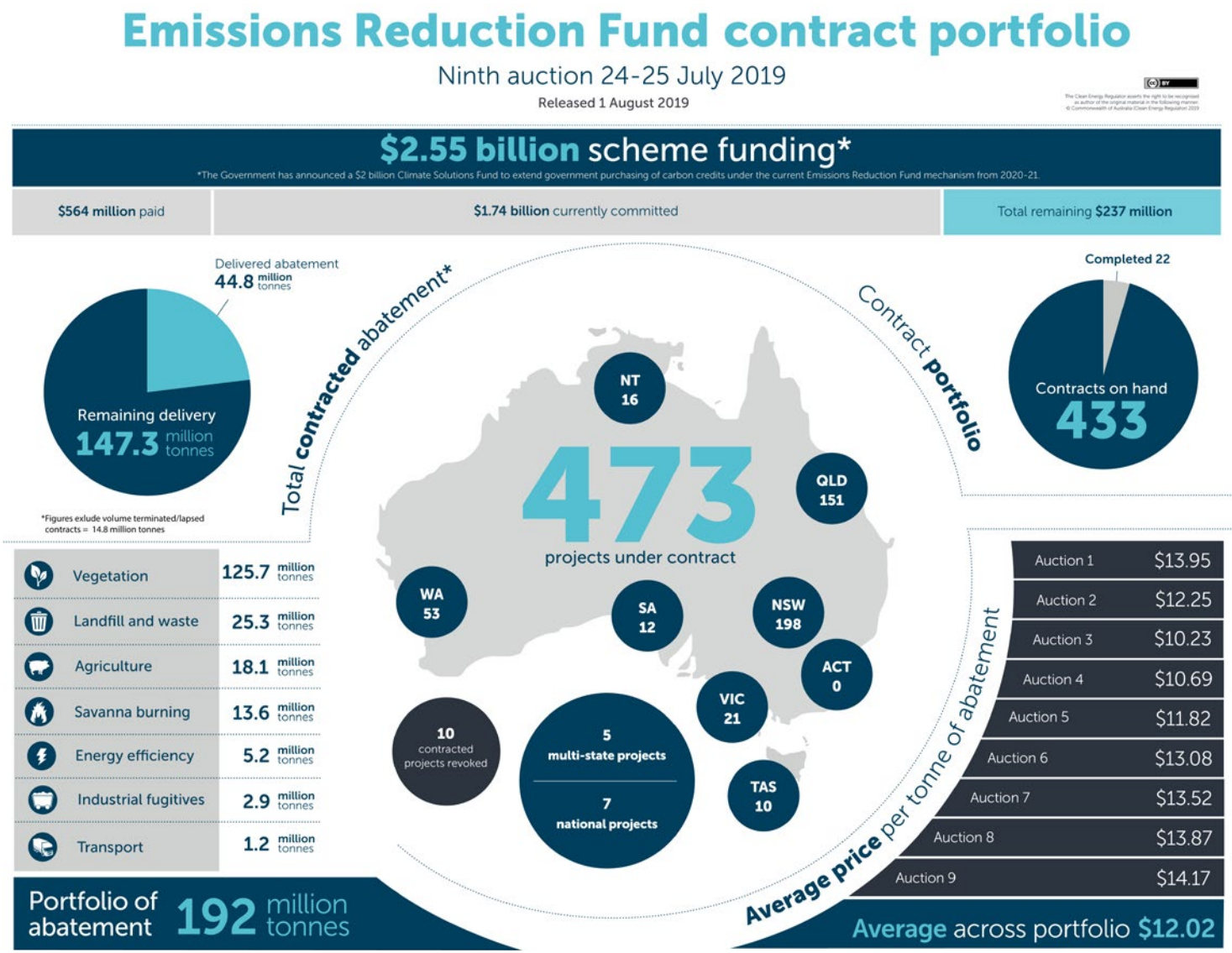
Participants receive one Australian carbon credit unit (ACCU) for every tonne of emissions they sequester or avoid through their project activities.

These units can be sold to the Australian Government under contract or sold to other businesses that are seeking to offset their emissions. Eligible activities include improving energy efficiency, fuel switching, capturing methane from landfills and storing carbon in forests and soils.

More than 780 emissions reduction projects are registered under the ERF, with over 470 contracted projects to deliver abatement. Since 2015, the Australian Government has contracted over 190 Mt of abatement through the ERF with an average price per tonne of abatement of $12.02. Figure 4.1 provides a summary of the ERF's contract portfolio after its ninth auction in July 2019, including the number of contracted projects, the sector and State and Territory breakdown and the amount of abatement contracted.

Many ERF projects have abatement profiles extending beyond 2020. The 2019 projections indicate the ERF is expected to deliver 61 Mt of contracted abatement to 2020 and is projected to deliver a further 240 Mt of abatement to Australia's 2030 emissions reduction target from contracted projects prior to 2020.

Figure 4.1 Combined results for all emissions reduction fund auctions



Source: Australian Clean Energy Regulator

Purchasing

In 2014, the Australian Government allocated $2.55 billion to purchase carbon credits through the ERF, using a competitive process of reverse auctions or other processes that represent value for money and comply with legislated purchasing principles.

The scheme is administered by the Clean Energy Regulator (CER), which manages the following functions under the ERF:

- registering projects
- running auctions
- managing contracts
- issuing ACCUs on achievement of emissions reductions.

The CER ensures participants comply with the legislated requirements of the ERF including that projects are new, not required by law and are not funded by other listed government programs.

Participants register a project and bid to enter into contracts of up to 10 years duration with the Government. If projects do not earn sufficient credits to meet the contractual obligations, the participant may need to 'make good' by buying carbon credits from someone else. Participants may also sell carbon credits generated under the ERF privately, for example to entities wanting to offset their emissions.

Table 4.2 sets out the sectoral breakdown of activity in the ERF, including contracted abatement, by method, following the ninth auction in July 2019.

Table 4.2 Available methods in operation under the Emissions Reduction Fund

Project type	Registered projects	Contracted projects	Contracted emissions reductions (Mt CO_2-e)	Examples of eligible project activities
Agriculture	63	22	18.1	• Reducing emissions from beef cattle through dietary supplements or efficient herd management. • Capturing and destroying the methane from effluent waste at piggeries. • Building soil carbon through changed farming practices such as crop stubble retention.
Energy efficiency	45	11	5.2	• Reducing energy consumption through industrial energy efficiency upgrades (e.g. boilers and heat exchangers). • Whole building efficiency upgrades. • Installation of high efficiency commercial appliances like energy efficient street lights.
Industrial fugitives	18	5	2.9	• Capturing and destroying waste methane from coal mines. • Reducing fugitive emissions from oil and gas operations. • Reducing emissions at industrial facilities.
Savanna burning	74	45	13.6	• Managing bushfires in Australia's savannas to avoid high intensity fires.
Transport	6	2	1.2	• Reducing emissions from air, land and sea transport through new technologies and more efficient practices.
Vegetation	444	281	125.7	• Protecting native forests by reducing land clearing. • Planting trees to grow carbon stocks. • Regenerating native forest on previously cleared land.
Landfill and waste	138	107	25.3	• Reducing the amount of waste in landfill, through composting, resource recovery, or separating organic household waste using dedicated council bins. • Capturing methane from landfills and producing electricity. • Treating wastewater at places such as sewerage plants or abattoirs.
Total	788	473	192	• The full list of eligible activities is available here: www.environment.gov.au/climate-change/emissions-reduction-fund/methods

Ensuring integrity of the Emissions Reduction Fund

To be eligible to receive ACCUs under the ERF, emissions reduction activities must be genuine and additional, going beyond business as usual. This is achieved by specifying eligible emissions reduction activities in legislative instruments known as 'methods'. Methods also define how the emissions reductions are to be measured, verified, reported and monitored. Methods can only be made if the independent Emissions Reduction Assurance Committee (ERAC) confirm they comply with legislated 'Offsets Integrity Standards' (see Table 4.3). Methods are reviewed periodically to ensure they continue to meet these standards. Additionally, the Minister for Energy and Emissions Reduction is required by legislation to consider whether any adverse environmental, economic or social impacts are likely to arise from the activities covered by the method.

Table 4.3 Offsets integrity standards

The ERF is enacted through the Carbon Credits (Carbon Farming Initiative) Act 2011, the Carbon Credits (Carbon Farming Initiative) Regulations 2011 and the Carbon Credits (Carbon Farming Initiative) Rule 2015. The Act sets out offsets integrity standards for methods. Draft ERF Methods are assessed against the following criteria:	
Additional	Abatement is unlikely to occur in the ordinary course of events
Measureable and verifiable	Abatement can be measured and verified
Eligible	Emissions reductions credited must be able to be counted towards Australia's emissions reduction targets
Evidence based	Methods must be supported by clear and convincing evidence
Material	Project abatement and related significant emissions should be accounted for
Conservative	Estimates, assumptions and projections used in the methodology determination should be conservative

Emissions Reduction Assurance Committee

The Emissions Reduction Assurance Committee (ERAC), is an independent, expert committee, which assesses ERF methods against the Offsets Integrity Standards specified in legislation. The ERAC advises the Minister for Energy and Emissions Reduction on whether proposed new activities or variations to existing activities meet these standards. The Minister cannot make or vary a method without the ERAC having first determined that it meets the legislated Offsets Integrity Standards.

The ERAC also considers advice from the Clean Energy Regulator, an independent statutory agency, on implementation of proposed methods.

The ERAC undertakes public consultation on draft methods to inform their advice to the Minister. The consultation period for draft methods or variations of existing methods is 28 days, unless the ERAC determines a shorter period (no less than 14 days) is appropriate. The ERAC monitors and reviews the effectiveness of methods over time and advises the Minister whether or not the method should continue to apply.

Safeguard Mechanism

The Safeguard Mechanism provides a framework for Australia's largest emitters to measure, report and manage their emissions. The mechanism complements the emissions reduction elements of the ERF by sending a signal to businesses to avoid increases in emissions beyond business-as-usual levels. It achieves this by placing emissions limits—called baselines—on large emitters, giving covered businesses a legislated obligation to keep net emissions below their baseline.

The mechanism operates under the framework of the National Greenhouse and Energy Reporting scheme (NGERS) and applies to facilities with direct scope 1 emissions of more than 100,000 tonnes of carbon dioxide equivalent (CO_2-e) per year (the baseline). It covers over 200 facilities and applies to around half of Australia's emissions, including the manufacturing, mining, oil and gas, transport, and electricity sectors.

Baselines were initially set at the highest level of reported emissions between 2009–10 and 2013–14 (reported baselines). In March 2019, the mechanism was amended to update baselines over 2018–19 and 2019–20. As a result, previously reported baselines for the period 2009-10 and 2013-14 expire on 1 July 2020. The amendments allow baselines to annually adjust for actual production. This means that baselines can reflect facility specific circumstances, such as fluctuations in production to meet changes in global commodity markets.

The CER administers the Safeguard Mechanism in accordance with the *National Greenhouse and Energy Reporting Act 2007* and supporting legislative instruments.

Hydrofluorocarbon phase-down policy

In 2017, Australia became the tenth country to ratify the Kigali Amendment to phase down hydrofluorocarbon (HFC) production and imports under the Montreal Protocol. Australia commenced its legislated phase down, which starts 25 per cent below the baseline and a year ahead of the Montreal Protocol's obligations, in 2018. Australia will import 25 per cent less HFCs in the period 2018 to 2036 than permitted under the Montreal Protocol, reducing emissions by 23 Mt of CO_2-e between 2018 and 2036.

Australia has controlled the use and emissions of synthetic greenhouse gases since 2003, with the focus on refrigeration and air conditioning, which make up over 80 per cent of emissions. End use controls were introduced in 2005 in the refrigeration and air conditioning, and fire protection industries. The end use controls restrict access and use of synthetic greenhouse gases in these industries to licensed businesses and technicians who have the skills to minimise preventable emissions. This approach, combined with mandatory product stewardship for refrigerants and bans on disposable cylinders reduced emissions by 11.5 Mt CO_2-e in the period 2003 to 2013, and will prevent emissions of 41.25 Mt CO_2-e in the period 2014 to 2030.

The phase out of ozone depleting chemicals such as CFCs (chlorofluorocarbons) and halon under the Montreal Protocol has provided a significant side benefit to the climate. These chemicals are potent greenhouse gases with global warming potentials many thousands of times that of carbon dioxide. They are not included in emission calculations as they are managed under the Montreal Protocol. However, phasing out production, importing and minimising preventable emissions through minimum skills, product stewardship and banning disposable cylinders has significantly benefited the global climate. Australia phased out the production and import of these chemicals faster than required under the Montreal Protocol.

Renewable Energy Target

The RET is an Australian Government scheme designed to reduce greenhouse gas emissions in the electricity sector by encouraging additional generation of electricity from renewable sources. The CER administers the RET through the *Renewable Energy (Electricity) Act 2000* and supporting legislation.

This scheme creates a guaranteed market for additional renewable energy deployment using a mechanism of tradable certificates that are created by renewable energy generators (such as wind farms) and owners of small-scale renewable energy systems (such as solar PV). Demand for certificates is created by placing a legal obligation on entities that buy wholesale electricity (mainly electricity retailers) to source and surrender these certificates to the CER to demonstrate their compliance with annual obligations.

The RET operates as two schemes:

- The Large-scale Renewable Energy Target (LRET) encourages investment in renewable power stations to achieve 33,000 gigawatt hours of additional renewable electricity generation by 2020.
- The Small-scale Renewable Energy Scheme (SRES) assists households, small business and community groups with the upfront cost of installing small-scale renewable energy technologies such as rooftop solar PV and solar hot water systems.

The CER informs project investors and provides transparency to consumers by providing annual updates on progress towards the 2020 target. Data supporting estimates of changes in emissions levels are captured by the national greenhouse gas inventory through NGERS.

Increasing Energy Efficiency

Equipment Energy Efficiency measures

The Equipment Energy Efficiency commenced in 1992, is a cross-jurisdictional program through which the Australian, state and territory governments and the New Zealand Government collaborate to deliver a single, integrated program on energy efficiency standards and energy labelling for equipment and appliances. The program currently regulates 22 products by way of Minimum Energy Performance Standards and/or an Energy Rating Label.

Australia is introducing a new Zoned Energy Rating Label for air conditioners to provide consumers with improved information about the expected energy use for air conditioners based on where they live. The Zoned Energy Rating Label provides information on energy efficiency over the course of a year and comparative energy use in three different climate zones across Australia.

The energy efficiency rating method, used for the old energy rating label for air conditioners, has not kept pace with technology changes, in particular the widespread uptake of inverter driven technology for residential air conditioners. The cost savings to consumers through to 2030 are anticipated to be in the order of $250 million with cumulative GHG emissions reductions through to 2030 of approximately 0.95 Mt CO_2-e.

Buildings Energy Efficiency measures

The Commercial Building Disclosure (CBD) program was established by the *Building Energy Efficiency Disclosure Act 2010* and requires energy efficiency information to be provided when commercial office space of 1000 square metres or more is offered for sale or lease.

The commercial building sector is responsible for around 25 per cent of Australia's overall electricity use and 10 per cent of Australia's total greenhouse gas emissions. Disclosing the energy efficiency of a building provides potential owners or tenants with consistent and meaningful information about a building's performance, making it easier for them to make an informed decision.

The program was first reviewed in 2015 and found to be effective at motivating owners of poorly performing office buildings to improve the energy efficiency of those buildings, delivering $44 million in net benefits in its first four years. Consideration will be given to the expansion of the CBD program following its 2019 review, which is due for completion in early 2020.

In February 2019, COAG Energy Council agreed to a Trajectory for low energy buildings, a national plan that sets a pathway towards zero energy (and carbon) ready buildings for Australia. This trajectory was developed as part of measure 31 under the NEPP to advance National Construction Code (NCC), to achieve better energy efficiency outcomes for Australia's buildings.

The trajectory identifies opportunities for the building sector in the context of a broader trajectory for the sector, and in summary proposes:

- setting a trajectory towards zero energy (and carbon) ready buildings
- implementing cost effective increases to the energy efficiency provisions in the NCC for residential and commercial buildings from 2022
- considering options for improving existing buildings in late 2019.

Energy efficiency requirements for new housing and non-residential buildings are set by the NCC. In 2019, the energy efficiency requirements for commercial buildings was increased. New homes in Australia have steadily increased their thermal performance in the NCC from around 3.5 Nationwide House Energy Rating Scheme (NatHERS) stars in 2003 to six stars in 2010. Work is underway to consider increasing the energy efficiency provisions in the NCC for residential buildings in 2022.

The Government is also improving existing rating tools and information resources for the commercial and residential building sectors. The National Australian Built Environment Energy Ratings System (NABERS), which underpins the CBD program, is expanding the voluntary NABERS component to other building types. The NatHERS, which is one of three pathways by which residential buildings can achieve compliance with the NCC, currently rates approximately 70 per cent of new houses and apartments each year. NatHERS provides the methodology to estimate and rate the potential thermal performance of residential buildings on a scale from 0 to 10. It is currently being expanded to also cover appliances and energy generation/storage to provide a whole-of-home rating. The Your Home information resource, which is Australia's most comprehensive guide to building, buying or renovating a home (www.yourhome.gov.au), is also being updated and expanded.

Technology

Clean Energy Innovation

Technological developments and improvements will play a critical role in the global transition to a lower emissions future. The Australian Government supports clean energy innovation across the spectrum of research and development, demonstration and deployment. Research and development grants are provided by ARENA, the Australian Research Council and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). Seed funding for emerging technology is provided by the Clean Energy Innovation Fund, established within the CEFC and is operated in consultation with ARENA. Projects near commercial deployment can access debt and equity from the CEFC.

Australian Renewable Energy Agency (ARENA)

ARENA is a statutory authority established by the *Australian Renewable Energy Agency Act 2011*, with a funding envelop of $3.2 billion to 2022 to increase the supply and competitiveness of renewable energy sources in Australia.

The agency commenced operations on 1 July 2012, and provides research, development and deployment grant funding to improve the affordability and increase the supply of renewable energy in Australia.

As at 30 June 2019, ARENA committed approximately $1.4 billion to over 478 projects with a total value of over $5.49 billion inclusive of co-funding matched by private sector and industry. These funds have supported projects spanning the commercialisation pathway, from research and development to demonstration and near-commercial deployment projects.

ARENA's current funding priorities are:

- integrating renewables into the electricity system
- accelerating hydrogen and
- supporting industry to reduce emissions.

Clean Energy Finance Corporation (CEFC)

The CEFC is a statutory authority established by the *Clean Energy Finance Corporation Act 2012*, which commenced operations on 1 July 2013. The CEFC's mission is to increase the flow of finance into Australia's clean energy sector, by providing debt and equity funding to promote investment in clean energy technologies. This is achieved through direct investments which attract private sector finance, as well as making indirect investments through its strategic co-financing partners. Projects near commercial deployment can access debt and equity from the CEFC at close to market rates.

As at 30 June 2019, the CEFC has made cumulative investment commitments of $7.2 billion to projects worth over $24 billion. These projects will reduce emissions from energy and industrial processes, and include investments in solar energy and energy storage. The CEFC invests commercially to increase the flow of funds into renewable energy, energy efficiency and low emissions technologies. Each dollar of CEFC investment has leveraged $2.20 in private sector investment. The CEFC's investment portfolio is expected to generate a return above the Government's costs of funds.

In 2016, the Australian Government agreed to create three new funds within the CEFC:

- The Clean Energy Innovation Fund: $200 million fund, co-managed with ARENA to support early stage and emerging clean energy technologies
- The Sustainable Cities Investment Program: The Program supports the national Smart Cities Agenda by investing in energy efficiency, renewable energy and low emissions technology projects that improve Australian cities.
- Reef Funding Program: The Program provides up to $1 billion over 10 years for clean energy projects benefiting the health of the Great Barrier Reef. The Reef Funding Program will contribute to the implementation of the Reef 2050 Plan, the overarching framework for protecting and managing the Great Barrier Reef.

The CEFC also works through banks and other financial institutions to offer financial products to encourage businesses to make sustainable purchasing choices for energy efficient equipment, fuel efficient, electric and hybrid vehicles, and to implement small scale behindthemeter renewable energy projects.

Mission Innovation

Australia is a founding member of Mission Innovation—a global initiative to increase public investment in clean energy research and development (R&D), as part of a global effort to accelerate innovation breakthroughs in clean energy technologies. Its inception was announced at the Conference of the Parties (COP) 21 meeting in Paris, November 2015 by Bill Gates and the presidents of the USA, France and India.

Australia co-leads the Renewable and Clean Hydrogen Innovation Challenge.

Solar Communities

The Solar Communities program provided $5 million in funding for community groups to install rooftop solar panels, solar hot water and solar-connected battery systems. It supported local responses to climate change and delivered lower electricity costs for community organisations. Funding for the program was targeted to specific regions and ended in June 2018, with funding provided to 385 community organisations.

Carbon Capture and Storage (CCS)

The Australian Government recognises the importance of investing in technologies to accelerate their commercial feasibility, uptake and deployability. Together with the private sector, the Government is supporting CCS research, development and demonstration activities, a vital technology to deliver emissions neutrality.

Both federal and state governments in Australia have been major contributors to CCS research and development. The federal government passed the *Offshore Petroleum Amendment (Greenhouse Gas Storage) Act 2008, which provides a regulatory framework for carbon dioxide storage in federal offshore waters. The Victorian Government's Greenhouse Gas Geological Sequestration Act 2008 (No. 61 of 2008)* provides a dedicated legal framework enabling the offshore injection and permanent storage of greenhouse gas substances (those sites falling within the three nautical mile extent of state jurisdiction).

Commonwealth Government led or funded CCS initiatives include:

- the CO_2 Cooperative Research Centre (founded 2003)
- the Low Emission Technology Demonstration Fund (2004–2017)
- Asia-Pacific Partnership on Clean Development and Climate (2006–2011)
- National Low Emissions Coal Initiative (founded 2008)
- Global CCS Institute (founded 2009)
- Carbon Capture and Storage Flagships (2009–2019)
- Carbon Capture and Storage Research Development and Demonstration Fund (2015–2016)
- National CO_2 Infrastructure Plan operated by Geoscience Australia (2012–2016)
- Roadmap for Carbon Capture and Storage for Australia (2017)

There is currently one commercial-scale CCS project in Australia. Chevron's Gorgon project (Western Australia), commenced capturing carbon dioxide from its natural gas field in mid-2019. Each year 3 to 4 Mt of carbon dioxide will be injected into undersea storage, reducing emissions from the facility by around 40 per cent.

Australia also has a number of CCS demonstration projects, including:

- The CarbonNet Project (CarbonNet) is investigating the potential for a commercial scale CCS network in the Gippsland region of Victoria. The network could integrate multiple carbon dioxide capture projects in the Latrobe Valley, transporting carbon dioxide via a common-use pipeline and injecting it deep beneath the Gippsland Basin to be securely stored within suitable geological formations. CarbonNet could enable innovative new industries in Gippsland securing jobs, boosting skills and attracting investment while strengthening Victoria's energy security.
- The Cooperative Research Centre for Greenhouse Gas Technologies Otway research facility is Australia's first demonstration of the deep geological storage of carbon dioxide. The project provides technical information on the injection, storage and monitoring of carbon. This information will influence national policy and industry while providing assurance to the community. The facility demonstrates that carbon capture and storage is safe, cost-effective and meets the expectations of government and the community.
- The National Geosequestration Laboratory delivers innovative research solutions to support Australia's carbon storage, energy and resources industries. For example, it is the lead research partner for the South West Hub CCS project in Western Australia.

Technology Investment Roadmap

Australia has been working on a technology strategy to support its long-term transition to lower emissions and ensure its research, development and deployment of investments provide the right support at the right time along the innovation chain.

As part of this work, the Technology Investment Roadmap will be released in December 2019. This will set a vision for Commonwealth technology investments. This approach to technology investments will be a core element of Australia's Long Term Low Greenhouse Gas Emissions Strategy (to be completed 2020).

Hydrogen

In November 2019, Australia released its National Hydrogen Strategy. The Strategy, led by Australia's Chief Scientist, Dr Alan Finkel, AO, was commissioned by the COAG Energy Council. The COAG Energy Council agreed to establish a Working Group to support the development of a clean, innovative and competitive hydrogen industry that benefits all Australians. It aims to be a major global player by 2030 by supporting the global transition to a lower emissions future.

The Strategy examines hydrogen exports; hydrogen for transport; hydrogen in the gas network; hydrogen for industrial users; hydrogen to support electricity systems; and cross-cutting issues. It provides an overarching framework for all jurisdictions to align their priorities, streamline regulatory and approval processes and inform safety requirements, training and skills requirements over the next 10 years.

The Australian Government has already invested $146 million in supporting hydrogen projects. A further $370 million will be invested in Hydrogen projects through CEFC and ARENA. The Australian Government, together with CSIRO, is also co-leading the Mission Innovation Renewable and Clean Hydrogen Challenge to advance hydrogen technology. In total, the Australian Government has committed over $500 million dollars to hydrogen industry since 2015.

Voluntary Action (Carbon Neutral Certification)

The Climate Active Carbon Neutral Standard (the Standard), administered by the Department of the Environment and Energy, enables organisations, products, services, events, buildings and precincts to take credible voluntary action on climate change. The Standard sets out requirements for achieving carbon neutrality, through a rigorous and transparent framework that is based on Greenhouse Gas Protocols and relevant international standards and is tailored to the Australian context. Carbon neutrality is achieved when net greenhouse gas emissions are equal to zero. This can be achieved by reducing emissions and then purchasing and retiring offset units to match or 'offset' the remaining emissions.

Certification against the Standard not only results in greenhouse gas reductions but also give participating businesses a competitive edge in the market place. The carbon neutral certification trade mark can be used by business for promotional and marketing purposes.

A new, client-facing brand and trademark 'Climate Active' was launched in November 2019. Professional marketing materials have been developed with the new trademark to increase the value of the certification and improve public awareness of the role of carbon neutral certification in addressing climate change.

The Standard is designed to provide confidence in the environmental integrity of the carbon neutral claim for consumers and businesses alike. It helps businesses determine their carbon account (also known as a carbon footprint) in line with consumer expectations for environmentally responsible business practices, and ensures they back their carbon neutral claim through the cancellation of robust offset units. It also assists consumers to interpret carbon neutral claims and make informed choices.

Carbon neutral certification is based on an annual cycle of measuring, reducing, offsetting and reporting. The integrity of a carbon neutral claim largely relies on the transparency of measures taken to support the claim. Certification against the Standard requires entities to publish a Public Disclosure Statement so that their carbon neutral claim can be objectively assessed by the public.

Organisations seeking to voluntarily offset their emissions or achieve carbon neutrality under the Standard are able to purchase from a range of eligible offset units. A list of eligible offset units is provided and is updated as new information becomes available.

As of 1 November 2019, there are 120 certifications in the program— 61 organisations, 38 products/ services, 11 buildings and ten events.

More information is available at www.environment.gov.au/carbon-neutral.

4.6 Domestic institutional arrangements relating to Australia's QEERT

The Clean Energy Regulator

The Clean Energy Regulator was established on 2 April 2012 as an independent statutory authority by the *Clean Energy Regulator Act 2011*. The Regulator administers several pieces of legislation that underpin the Australian Government's approach, including the ERF, RET, National Greenhouse and Reporting Scheme (NGERS) and the Safeguard Mechanism.

The Clean Energy Regulator monitors compliance with climate change laws, including the ERF, to determine compliance levels, identify possible non-compliance and assess the education or enforcement action that may be required. The Regulator gathers information, conducts independent audits and undertakes inspections. It also holds enforcement powers which include:

- accepting enforceable undertakings from a regulated entity
- issuing infringement notices, or
- pursuing legal action for breaches of civil penalty provisions.

Criminal sanctions apply for persons or organisations found to have breached offence provisions contained in climate change laws, or if a person or organisation is found to have engaged in dishonest or fraudulent conduct in connection with schemes established by those laws.

The Climate Change Authority

The Climate Change Authority (the Authority), created on 1 July 2012, is an independent statutory agency established by the *Climate Change Authority Act 2011* (CCA Act). The Authority is required to conduct periodic reviews of:

- The Carbon Credits (Carbon Farming Initiative) Act 2011 (Commonwealth) and associated instruments. This incorporates the ERF.
- The National Greenhouse and Energy Reporting Act 2007 and associated instruments.

Reviews are undertaken on other matters as requested by the Minister responsible for climate change policy or the Australian Parliament. The Authority also conducts and commissions its own independent research and analysis. The Authority has completed the following reviews since the third Biennial Report:

- review of the Emissions Reduction Fund, 2017
- review of the National Greenhouse and Energy Reporting legislation, 2018
- *Reaping the rewards,* a research report on delivering emission reductions and other environmental benefits on the land, 2018
- review of the National Wind Farm Commissioner, 2018
- background research papers - Stocktakes of current Australian and international climate change policies and industry action on climate change mitigation in Australia, 2019.

For more information on the outcome of reviews conducted by the Authority, see the Reviews and Publications sections of the Climate Change Authority website at: http://climatechangeauthority.gov.au.

4.7 Addressing adverse effects, economic and social consequences of response measures

Australia has a proven track record or setting targets and policies that are achievable and responsible, and ensure economic growth while supporting jobs and regional communities. We are currently in our 28th year of continued economic growth and our emissions per person are at their lowest level in 29 years.

Policy development in Australia is typically accompanied by consultation processes that enable those potentially affected to raise concerns and present ideas.

Impact assessment is an integral part of Australia's policy development process. Any legislation introduced to the Australian Parliament must be accompanied by a Regulatory Impact Statement that assesses the economic and social impacts of the measure.

4.8 Estimates of emission reductions and removals from LULUCF activities

Australia has used the KP classification system for reporting estimates from the LULUCF sector, as discussed in section 3.2. For all LULUCF classifications, emission estimates in the reporting period may be compared with estimates in the base-year, which is 2000. In summary, the net emissions from the LULUCF sector were –23.3 Mt CO_2-e in 2017, which were 78.6 Mt CO_2-e less than net emissions in 2000. Information on the contribution of the LULUCF sector to Australia's progress towards its 2020 target is provided in CTF Tables 4, 4(a)I and 4(b).

Coverage

Australia reported net emissions from deforestation, afforestation/reforestation, forest management, cropland management, grazing land management and revegetation. The concordance between the two classification systems is set out in Table 4.4.

Table 4.4 Reconciliation table between UNFCCC and KP classifications

UNFCCC	KP
Forest land	
Forest land – multiple-use public forest	*Forest management*
Forest land – pre-1990 plantations	*Forest management*
Forest land– harvested private native forests	Monitored for *forest management* activity
Forest land – other native forest	Monitored for *forest management* activity
Forest land – biomass burning in non-temperate areas	*Grazing land management*
Land converted to forest	
New plantations since 1990	*Afforestation/reforestation*
Native regeneration since 1990 – direct human-induced	*Afforestation/reforestation*
Forest land previously converted to other land uses since 1990	*Deforestation*

UNFCCC	KP
Forest land previously converted to cropland prior to 1990	*Cropland management*
Forest land previously converted to grassland, wetland or settlement prior to 1990	*Grazing land management*
Cropland	
Cropland – permanent	*Cropland management*
Forest land converted to cropland since 1990	*Deforestation*
Forest land converted to cropland prior to 1990	*Cropland management*
Grassland converted to cropland	*Cropland management*
Grassland	
Grasslands – permanent	*Grazing land management*
Forest land converted to grassland since 1990	*Deforestation*
Forest land converted to grassland – pre-1990 conversion	*Grazing land management*
Settlements	*Revegetation* may occur
Forest land converted to settlements	*Deforestation*
Wetlands	
Wetlands – sparse woody vegetation	*Revegetation* may occur
Wetlands – biomass burning in non-temperate areas	*Grazing land management*
Forest land converted to wetland – post-1990	*Deforestation*

Deforestation

The net emissions from deforestation classification were 26.1 Mt CO_2-e in 2017, which was 44.5Mt CO_2-e less than in 2000. The classification definitions and the methodologies used to derive the estimates are described in the latest NIR 2019 Volume 3.

Afforestation/reforestation

The net emissions from the afforestation/reforestation classification were –29.4 Mt CO_2-e in 2017, which was 15.9 Mt CO_2-e less than in 2000. The classification definitions and the methodologies used to derive the estimates are described in the NIR 2019 Volume 3.

Forest management

The net emissions from forest management classification were –25.6 Mt CO_2-e in 2017, which was 14.6 Mt CO_2-e less than in 2000. For forest management, reference level accounting, as is applicable to Australia's KP CP2 target, has not been applied to reporting against Australia's 2020 target. Instead, forest management is treated the same way as is any other sector.

Harvested wood products are estimated using the IPCC production approach.

Natural disturbance (wildfire) impacts are estimated using the IPCC default method for treatment of natural disturbances as explained in the latest NIR 2019 Volume 3.

Natural disturbance impacts are 'beyond control' and 'not materially influenced' by Australia, as they occur in spite of significant and costly efforts to manage disturbance. Australia engages in on-going efforts to prevent, manage and control natural disturbances to the extent practicable (and as reported in the latest NIR 2019).

Australia's national forest carbon monitoring system is used to estimate the emissions and is also used to exclude subsequent removals from the lands affected by natural disturbances, as well as to monitor lands affected by natural disturbances for salvage logging or subsequent land-use change in order to account for any associated emissions.

Australia does not apply a cap in accounting for Forest Management in reporting against its 2020 target.

Cropland management

The net emissions from cropland management classification were –2.2 Mt CO_2-e in 2017, which was 4.1 Mt CO_2-e more than in 2000. The classification definitions and the methodologies used to derive the estimates are described in the NIR 2019 Volume 3.

Grazing land management

The net emissions from grazing land management classification were 7.8 Mt CO_2-e for 2017, which was 7.5 Mt CO_2-e less than in 2000. The classification definitions and the methodologies used to derive the estimates are described in the NIR 2019 Volume 3.

Revegetation

The net emissions from revegetation classification were 0.01 Mt CO_2-e for 2017, which was 0.26 Mt CO_2-e less than in 2000. The classification definitions and the methodologies used to derive the estimates are described in the NIR 2019 Volume 3.

Other

Australia does not include estimates of emissions from drainage and rewetting of organic soils.

5. Projections

Key developments

Current emissions projections show Australia continues to make progress in reducing emissions.

Australia is expected to surpass the emissions reductions required to meet its **2020 target (5 per cent below 2000 levels)** by 283 Mt CO_2-e. If Australia's carryover of 128 Mt CO_2-e from the first commitment period of the Kyoto Protocol is included, the overachievement is 411 Mt CO_2-e.

Australia has reduced the abatement task to achieve its **2030 target (26-28 per cent below 2005 levels).** If overachievement is included, Australia will overachieve on its 2030 target (26 per cent target) .

This chapter presents Australia's 2019 greenhouse gas emissions projections. Australia publishes projections of greenhouse gas emissions annually on the Department of the Environment and Energy website. The estimates of greenhouse gas emissions from 1990 to 2017 in this chapter are consistent with Australia's 2017 National Inventory Report. Projections of greenhouse gas emissions from 2018 to 2030 are consistent with Australia's Emissions Projections 2019, which includes updates to the national greenhouse gas inventory since NIR 2017.

The following sections outline Australia's approach to emissions projections, projection results, sectoral trends and sensitivity analysis.

5.1 Australia's approach to emissions projections

Australia's emissions projections are prepared by gas and by sector. Emissions by gas are expressed in terms of carbon dioxide equivalent (CO_2-e) using the 100 year global warming potentials contained in the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report. As greenhouse gases vary in their radiative activity and in their atmospheric resistance time, converting emissions into CO_2-e allows for the integrated effect of emissions of the various gases to be compared.

The emissions projections are estimated on a United Nations Framework Convention on Climate Change (UNFCCC) accounting basis consistent with Australia's accounting for the 2030 targets. Reporting years for all sectors are reported for financial years as key data sources are published on this basis. For instance, '2030' refers to financial year 2029–30.

Sectors reported are: energy (subdivided into electricity, direct combustion[1], transport, and fugitive emissions); industrial processes and product use; agriculture; waste; and land use, land use change and forestry.

1 Direct combustion sector is defined as stationary energy, excluding electricity.

The projections are prepared on the basis of current implemented and adopted policies and measures as of October 2019. These include:

- the Emissions Reductions Fund (ERF)
- the Climate Solutions Package, including the Climate Solutions Fund (CSF)
- Large-scale Renewable Energy Target of 33,000 GWh by 2020 and the Small-scale Renewable Energy Scheme
- Implemented initiatives under the National Energy Productivity Plan, ARENA and the CEFC
- State-based waste policy frameworks and the National Food Waste Strategy
- State renewable energy targets
- Energy Performance, refrigeration and air conditioning measures, and
- Legislated phase-down of hydrofluorocarbons.

The projections do not take account of policies and initiatives undergoing development such as the National Electric Vehicle Strategy.

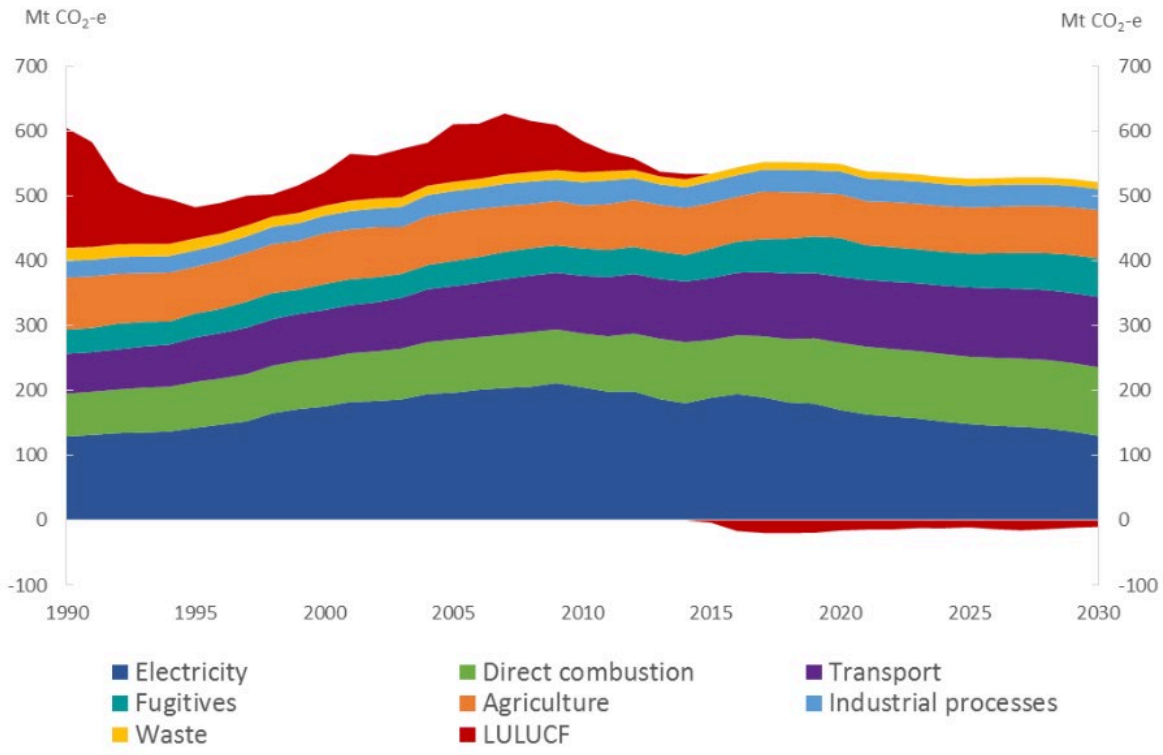
5.2 Summary of Australia's emissions projections

Australia assesses progress against its 2020 target, of five per cent below 2000 levels, using an emissions budget approach. A trajectory to achieve the emissions budget is calculated by taking a linear decline from 2010 to 2020, beginning from the Kyoto Protocol first commitment period target level and finishing at five per cent below 2000 level emissions in 2020. Australia's progress is assessed as the difference in cumulative emissions between projected emissions and the target trajectory over the second commitment period of the Kyoto Protocol (2013 to 2020).

Australia's Emissions Projections 2019 reported Australia is on track to overachieve its 2020 target by 283 Mt CO_2-e without carryover. For completeness, this includes 28 Mt CO_2-e CERs gifted to the Australian Government by landfill operators under the Waste Industry Protocol. If carryover from CP1 is included, the overachievement is 411 Mt CO_2-e.

Australia also assesses progress against its 2030 target, of 26 to 28 per cent below 2005 levels, using an emissions budget approach over ten years from 2021 to 2030. Australia's Emissions Projections 2019 reported Australia would require emission reductions between 395 Mt CO2-e (26 per cent reduction) and 462 Mt CO_2-e (28 per cent reduction) over the period 2021 to 2030 to meet Australia's 2030 target. This is a downward revision of 473 Mt CO_2-e since Australia's Third Biennial Report. If overachievement from previous targets is included, the cumulative emissions reduction task is reduced to -16 Mt CO_2-e (26 per cent reduction) and 51 Mt CO_2-e (28 per cent reduction).

Figure 5.1 Domestic emissions by sector, 1990 to 2030



Source: Department of the Environment and Energy 2019

Table 5.1 Summary of emissions projections by sector and gas

	Historical – GHG emissions and removals (Mt CO_2-e)						Projected – GHG emission projections (Mt CO_2-e)		
	1990	1995	2000	2005	2010	2015	2020	2025	2030
Electricity	130	143	175	197	205	189	170	149	131
Direct combustion	66	71	75	82	84	91	104	104	106
Transport	61	68	74	82	89	95	102	107	108
Fugitive	37	37	40	39	42	46	60	52	59
Agriculture	80	72	78	76	66	70	67	71	74
Industrial processes and product use	26	25	27	32	36	33	35	33	32
Waste	20	19	16	14	15	12	12	11	11
Land use, land use change and forestry	185	48	51	89	49	-4	-16	-11	-10
Gas									
CO_2 emissions including net CO_2 from LULUCF	444	338	383	458	437	383	394	381	370
CO_2 emissions excluding net CO_2 from LULUCF	278	305	350	387	406	403	414	395	383

	Historical – GHG emissions and removals (Mt CO_2-e)						Projected – GHG emission projections (Mt CO_2-e)		
	1990	1995	2000	2005	2010	2015	2020	2025	2030
CH_4 emissions including net CH_4 from *LULUCF*	135	123	127	121	116	113	108	105	111
CH_4 emissions excluding net CH_4 from *LULUCF*	120	111	113	108	103	101	105	102	109
N_2O emissions including net N_2O from *LULUCF*	20	19	23	25	24	23	19	20	21
N_2O emissions excluding net N_2O from *LULUCF*	16	15	19	20	19	19	18	19	20
HFCs	1	1	2	5	9	12	12	10	9
PFCs	5	2	1	2	0	0	0	0	0
SF_6	0	0	0	0	0	0	0	0	0
NF_3	-	-	-	-	-	-	-	-	-
Total with *LULUCF*	605	483	536	611	586	532	534	516	511
Total without *LULUCF*	420	435	485	522	537	535	549	527	521

Source: Department of the Environment and Energy 2019; Department of the Environment and Energy analysis

5.3 Overview of models and data sources

The projections are developed using a combination of top-down and bottom-up modelling prepared by the Department of the Environment and Energy analysts and external consultants. The Department draws on public data sources by government agencies and other bodies to inform estimates of production or activity growth at the sectoral or sub sectoral level. These estimates, with relevant emission factors, are then used to calculate emissions for sectors.

Data sources

The key data sources include:

- historical emissions data from the *National Inventory Report 2017*, released in May 2019, and the *Quarterly Update of Australia's National Greenhouse Gas Inventory,*
- macroeconomic assumptions of gross domestic product and exchange rates consistent with the Australian Government's 2019–20 Budget,
- population growth from the Australian Bureau of Statistics and the Treasury; and
- commodity forecasts and activity levels informed by a number of publications and data from government agencies and other bodies, including:
  - the Australian Bureau of Agricultural and Resource Economics and Sciences
  - the Department of Industry, Innovation and Science
  - the Bureau of Infrastructure, Transport and Regional Economics
  - the Australian Energy Market Operator.

Further information of sector specific sources can be found in the methodology and assumptions section of 5.4 Emissions Projections by Sector.

Summary of sectoral models

Table 5.2 summarises the models used for calculating emissions for each sector.

Table 5.2 Summary of sectoral models

Sector	Model (type, purpose)
Electricity	A simulation model used by consultants, Jacobs Australia. The simulation model emulates the dispatch mechanism of the electricity market using a multi-area probabilistic dispatch algorithm that determines dispatch of plant within each year and optimal choice of new plant over the modelling period.
Direct Combustion	Purpose built, bottom-up models estimating emissions based on estimates of production at the sub sectoral level.
Transport	Economic partial equilibrium model (Energy Sector Model) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) that covers all transport sub-sectors. Electrification of trucks and buses were separately modelled by Keypath Consulting in alliance with Ndevr Environmental.
Fugitives	Purpose built, bottom-up models estimating emissions based on facility level estimates of coal and LNG production. Sub-sectoral models based on state and national indicators for oil and fugitive emissions from natural gas.
Industrial processes and product use	Purpose built, bottom-up models estimating emissions based on estimates of production at the sub sectoral/ facility level.
Agriculture	Purpose built, bottom-up model estimating emissions based on agricultural production at the sub sectoral level.
Waste	Purpose built facility by facility model developed by consultants Blue Environment to calculate waste emissions based on forecasts of waste generation, waste mix, waste diversion and methane capture.
Land use, land use change and forestry	The Full Carbon Accounting Model (FullCAM) is the model used to construct and project Australia's national greenhouse gas emissions for the land sector. FullCAM deals with biological and management processes which affect carbon pools and the transfers between pools in forest and agricultural systems.

Preparation of Australia's emissions projections

Preparing the projections involves making forecasts about the growth path of future emissions. Australia recognises there can be considerable difficulty and uncertainty associated with making estimates about the future. Australia attempts to reduce some of this difficulty in its approach to projections through quality assurance processes. Preparation of the projections involves the following assumptions and processes:

- The initial starting point for the projections are the latest estimates of historical emissions from the National Greenhouse Gas Inventory.
- The projections are updated and published annually as part of assessing progress of Australia's achievement of its international emissions reduction targets.
- The approach to preparing the projections and the methodologies as well as the data sources used are reviewed annually as part of ongoing assessments to determine the appropriateness of current approaches and determine any potential improvements.
- The projections use data from publicly available information and estimates by government agencies, international sources and consultants. Macroeconomic parameters informing the projections are consistent with forecasts from authoritative national sources including the Australian Government Departments of the Treasury and the Australia Bureau of Statistics.
- Methodologies, assumptions and results for each sector are subject to review by a technical working group made up of representatives from government agencies and other experts. Projection results are also subject to extensive internal quality assurance and quality checking.
- For Australian Government policies and measures, estimates of abatement are modelled collaboratively by policy analysts with projection analysts/modellers.

5.4 Emission projections by sector

This section sets out the emissions projection results, key trends and drivers for each reported sector. Further information on sectoral results can be found in Australia's Emissions Projections 2019.

Projections of the energy sector (electricity)

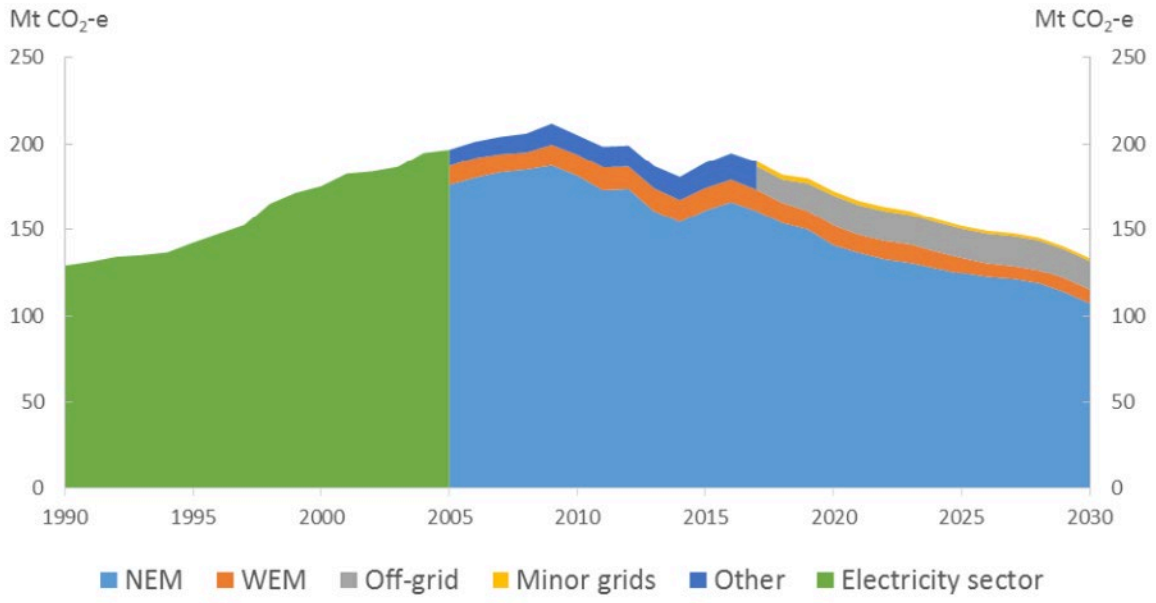
Emissions from electricity generation are the result of fuel combusted for the production of electricity in the National Electricity Market (NEM), Western Australia's Wholesale Electricity Market (WEM), the other small grids and off-grid.

Emissions trends

Since 2016, emissions in electricity have been falling, driven by large amounts of renewable generation entering the market supported by the large-scale renewable energy target. Over the projections period, emissions are projected to decline to reach 170 Mt CO_2-e in 2020, and are projected to further decline to reach 131 Mt CO_2-e in 2030.

These declines are driven by the projected continued decarbonisation of electricity generation across the country, including the country's largest market, the NEM. Large deployment of renewables, in particular rooftop solar, form a growing share of generation in the NEM.

Figure 5.2 Electricity emissions, 1990 to 2030



Source: Department of the Environment and Energy 2019

Emissions in the WEM are projected to decrease 4 Mt CO2-e from 2020 to 2030. Emissions decrease in 2021 as increased renewable capacity, particularly wind, comes online and generation from coal declines. Emissions increase in 2022 and 2023 as low renewables build, higher gas prices and growing demand results in increased coal generation. Emissions then decline as the WEM sees increased renewable generation.

Emissions from off-grid electricity use increase by 2 Mt CO2-e to 2020 before remaining relatively steady, as declining emissions from remote industry sites and communities is offset by electricity use to support the production of LNG.

Methodology and assumptions

NEM and WEM and minor grids

Jacobs Australia used Plexos, a market simulation model developed by Energy Exemplar, to project emissions in the NEM and WEM and minor grids to 2030. Plexos is a simulator that emulates the settlements mechanism. This model optimises dispatch using the same techniques that are used by the Australian Energy Market Operator (AEMO) to clear the NEM and WEM (and other grids) and incorporates Monte-Carlo forced outage modelling. It also uses mixed integer linear programming to determine an optimal long-term generation capacity expansion plan. Plexos is part of an integrated suite of models that include long-term planning for optimisation of generation new builds and market dispatch, supported by Jacobs Australia's proprietary model for Large-scale Generation Certificates (LGCs). Demand is included in the model as an exogenous assumption and presented to the market. Generator portfolios compete against this demand for dispatch.

Plexos accounts for the economic relationships between generating plants in the system. In particular, the model calculates production of each power station given the availability of the station, the availability of other power stations and the relative costs of each generating plant in the system.

Off-grid

Off-grid refers to all other locations where small electricity networks operate, this can include 'micro grids'. Off-grid electricity demand is dominated by industrial use from mining and LNG production.

Off-grid electricity emissions are calculated with two models. The first is a bottom-up model that is driven by the production of LNG at individual facilities, with production assumptions in line with estimates under the fugitives sector modelling. The second is a top-down model that is driven by demand growth in the overall subsector and the uptake of renewable technology in the form of solar generation.

For off-grid generation, emissions are calculated by:

$$E_t = \Sigma([G_{it} \,.\, EI_{ijt}])$$

Where:
E_t = annual emissions in year t (kt CO_2-e)
G_{it} = electricity generation by $fuel_i$, in year t (GWh)
EI_{ij} = the emissions intensity of generation by $fuel_i$ at $grid_j$, in year t (t CO_2-e/MWh coal)

Electricity demand

NEM and WEM

Forecasts of electricity demand are a key input into the electricity sector emissions projections. The Department has sourced data from the AEMO's Electricity Statement of Opportunities (ESOO) reports to inform electricity demand projections for the NEM and the WEM. The demand scenario that was included in the projections was the ESOO 2019 central scenario.

The electricity emissions projections include consumption of electricity from electric vehicles consistent with estimates in the transport sector.

Small grids and off-grid

Data and information from the Utilities Commission of the Northern Territory which include demand forecasts by AEMO for the Commission, and trends from the WEM ESOO are used in the minor grids of the DKIS and SWIS, respectively.

Off-grid demand is calculated using production estimates of LNG in line with assumptions under the Fugitives sector, and estimates under the report commissioned by the Department from ABMARC on electrification opportunities in Australian mining.

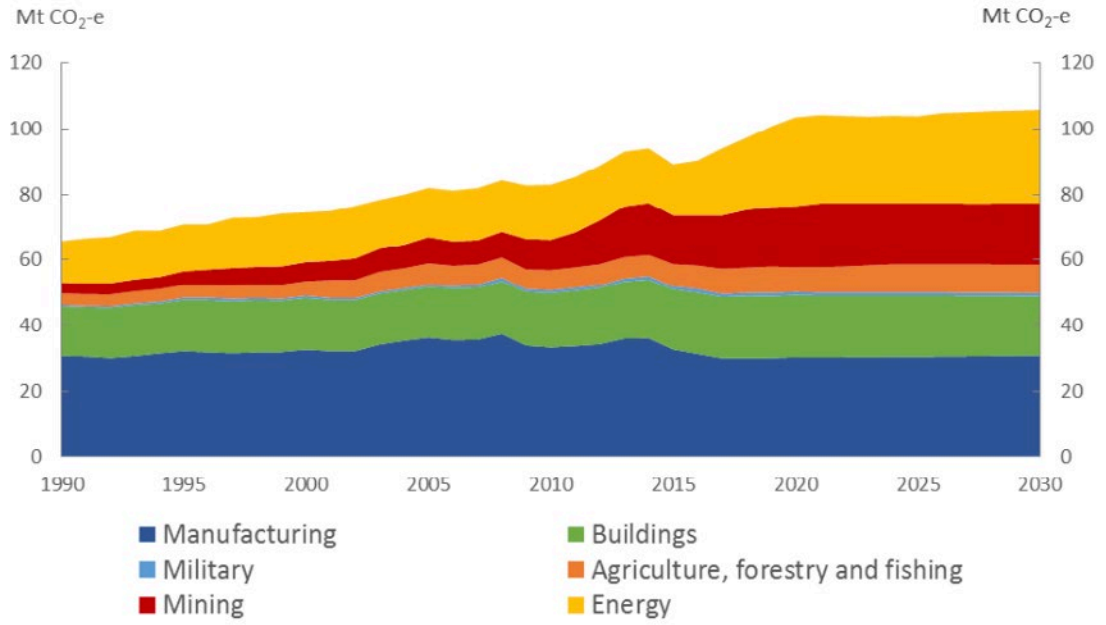
Table 5.3 Data source for electricity demand projections

Grid	Data source for electricity demand
National Electricity Market	AEMO Electricity Statement of Opportunities for the NEM
Wholesale Electricity Market	AEMO Electricity Statement of Opportunities for the WEM
Small grids: **Darwin Katherine interconnected system** **North West interconnected system**	NT Utilities Commission 2019 annual report, AEMO Electricity Statement of Opportunities for the WEM
Off-grid	LNG production consistent with production assumptions in the fugitives sector, ABMARC Australian Mining report 2019

Projections of the energy sector (direct combustion i.e. stationary energy excluding electricity)

Emissions from direct combustion are from the burning of fuels for energy used directly, in the form of heat, steam or pressure (excluding for electricity generation and transport). The direct combustion emissions are produced from almost all sectors of the economy. The direct combustion sector consists of six subsectors: energy, mining, manufacturing, buildings, agriculture, forestry and fishing, and military.

Figure 5.3 Direct combustion emissions, 1990 to 2030



Source: Department of the Environment and Energy 2019

Emissions trends

Direct combustion emissions have increased from 1990-2019 at an average rate of 1.5 per cent per year. Emissions are projected to be 104 Mt CO_2-e in 2020, reaching 106 Mt CO_2-e in 2030. Energy efficiency measures, technological improvement and fuel switching are the major factors contributing to the slower growth rate.

Manufacturing of goods and commodities is the largest subsector, contributing 30 Mt CO_2-e in 2020 and 31 Mt CO_2-e in 2030, around 30 per cent of direct combustion emissions. Nearly half of emissions result from the manufacture of basic nonferrous metals, such as alumina, aluminium and nickel.

The projected increase in emissions in the energy subsector is mainly driven by the growth in LNG production. LNG is the largest individual source of emissions within the direct combustion sector. Currently, 10 LNG plants with a combined capacity of 88 Mt of LNG per year are operating in Australia. Emissions from energy are projected to increase by 5 per cent from 2020 to 2030.

Emissions from buildings are projected to decrease by 4 per cent over the 2020s while emissions from agriculture, forestry and fishing are projected to grow steadily. Emissions from military and mining are projected to be flat from 2020 to 2030.

Methodology and assumptions

Direct combustion models are a combination of facility-specific and top-down models, depending on the nature of the emission source and the availability of data. The models are maintained and updated within the Department. The structure of these models is provided in Table 5.4.

The production data for LNG is estimated at the facility-level as each facility has a different emissions intensity. Where sufficient historical data is available, emissions intensity is calculated based on emissions reported through the National Greenhouse and Energy Reporting System. For new LNG projects, information provided in environmental impact statements is used to calculate the emissions intensity. Emissions intensity is updated yearly for each facility where data is available, and they are assumed to be constant across the projections period.

Activity data

Activity data used in the direct combustion subsectors is presented in Table 5.4.

Emissions projections in the direct combustion sector are estimated using activity data from a range of sources including, Office of the Chief Economist's (OCE) commodity forecasts, Australian Energy Update, AME Group's industry analysis, IBISWorld industry reports and AEMO's Gas Statement of Opportunities (GSOO), Merchant Research & Consulting Ltd Ammonia production forecast 2019.

Table 5.4 Summary of activity data and calculation methods for each direct combustion subsector

Emissions subsector	Activity data	Calculation method
Energy		
LNG (facility level model)	Production data from the *fugitives sector* and emissions intensity from NGER, various Environmental Impact Studies	$E_t = \sum([EI_{it} \cdot P_{it}])$ *Where:* E_t = *emissions in year t (Mt* CO_2*-e)* EI_{it} = *facility-specific emissions intensity in year t* P_{it} = *production at facility*$_i$ *in year t*
Other oil and gas extraction (top down model)	Western Australia Gas demand from AEMO 2018, East Coast gas demand from AEMO 2019b, crude and condensate oil demand from OCE 2019, 2019a.	$E_t = E_{t-1} \cdot \Delta$ *Production* *Where:* E_t = *emissions in year t (Mt* CO_2*-e)* E_{t-1} = *emissions in the previous year* Δ *Production = percentage change in production between year t and year t-1*
Manufacture of solid fuels (top down model)	Iron and steel growth rates from OCE 2019, OCE 2019a and AME Group's industry analysis	
Domestic gas production and distribution (top down model)	Western Australia Gas demand from AEMO 2018, East Coast gas demand from AEMO 2019b.	
Petroleum refining (top down model)	Total refinery output from OCE 2019,2019a	

Emissions subsector	Activity data	Calculation method
Mining		
Coal mining (facility level model)	Production data from the *fugitives sector,* technological improvement including fuel consumption savings and efficiency factors from ABMARC Australian Mining report 2019	$E_t = (E_{t-1} . \Delta$ *Production)*(1- Eti*$_t$*)* *Where:* E_t *= emissions in year t (Mt* CO_2*-e)* E_{t-1} *= emissions in the previous year* *Δ Production = percentage change in production between year t and year t-1* *Eti*$_t$*= emissions reduction from technological improvement in coal mining/ other mining in year t*
Other mining (iron ore; gold; copper; nickel; zinc; bauxite; lithium and manganese) (top down model)	Production data from OCE 2019, OCE 2019a, AME Group's industry analysis and derived proportion of the base year from NGER data, technological improvement including fuel consumption savings and efficiency factors from ABMARC Australian Mining report 2019	
Manufacturing (top down model)		
Non-ferrous metals (alumina; aluminium; refined nickel and lead/ acid battery)	Production data from OCE 2019, OCE 2019a, AME Group's industry analysis and derived proportion of the base year from NGER data	$E_t = E_{t-1} . \Delta$ *Production* Where: E_t = emissions in year t (Mt CO_2-e) E_{t-1} = emissions in the previous year Δ Production = percentage change in production between year t and year t-1
Non-metallic minerals (cement, lime, plaster and concrete; ceramics; glass and glass products and other)	IBISWorld industry reports analysis and derived proportion of the base year from NGER data	
Iron and steel	Production data from OCE 2019, OCE 2019a, and AME Group's industry analysis	
Pulp, paper and print	DoEE2019, 2019b, final data point held constant.	
Chemicals (other petroleum and coal product and basic chemical, chemical and plastic)	Ammonia Australia market outlook 2019 and derived proportion of the base year from NGER data	
Food processing, beverages and tobacco	n/a	10 year historical average emissions growth
Other manufacturing	n/a	

Emissions subsector	Activity data	Calculation method
Buildings (top down model)		
Residential and commercial	AEMO 2018 & 2019 for annual gas consumption, DoEE 2019c for wood and woodwaste fuel use, DoEE 2019d for derived proportion of emissions from wood biomass and others. The final numbers have been adjusted to incorporate energy efficiency improvements from the Climate Solution Package.	$E_{t=} E_{wt+} E_{ot}$ $E_{wt} = E_{wt-1} . \Delta$ *Consumption* $E_{ot} = E_{ot-1} . \Delta$ *Demand* *Where* E_{tr} *= emissions in year t (Mt* CO_2*-e)* E_{wt}*= emissions in year t (Mt* CO_2*-e) from burning wood biomass at residential buildings* Eo/w_{t-1} = emissions in the previous year from consumption of wood or other fuels Δ Demand = percentage change in gas consumption in commercial / residential buildings between year t and year t-1 Δ *Consumption = percentage change in wood consumption between year t and year t-1*
Construction	Activity data from ACIF 2019	$E_t = E_{t-1} . \Delta$ *Activity* Where: E_t = emissions in year t (Mt CO_2-e) E_{t-1} = emissions in the previous year Δ Activity = percentage change in activity between year t and year t-1
Agriculture, forestry and fishing (top down model)	Farm production data from ABARES 2019 and 2019a. Average rate of change in diesel consumption derived from NGER data	$E_t = (E_{t-1} . \Delta$ *Production) * (1-Dcr)* Where: E_t = emissions in year t (Mt CO_2-e) E_{t-1} = emissions in the previous year Δ Production = percentage change in production between year t and year t-1 Dcr=average rate of change in diesel consumption Emissions held constant at 2024 level.
Other (military) (top down model)	DoEE2019, 2019b	10 year average of historical emissions

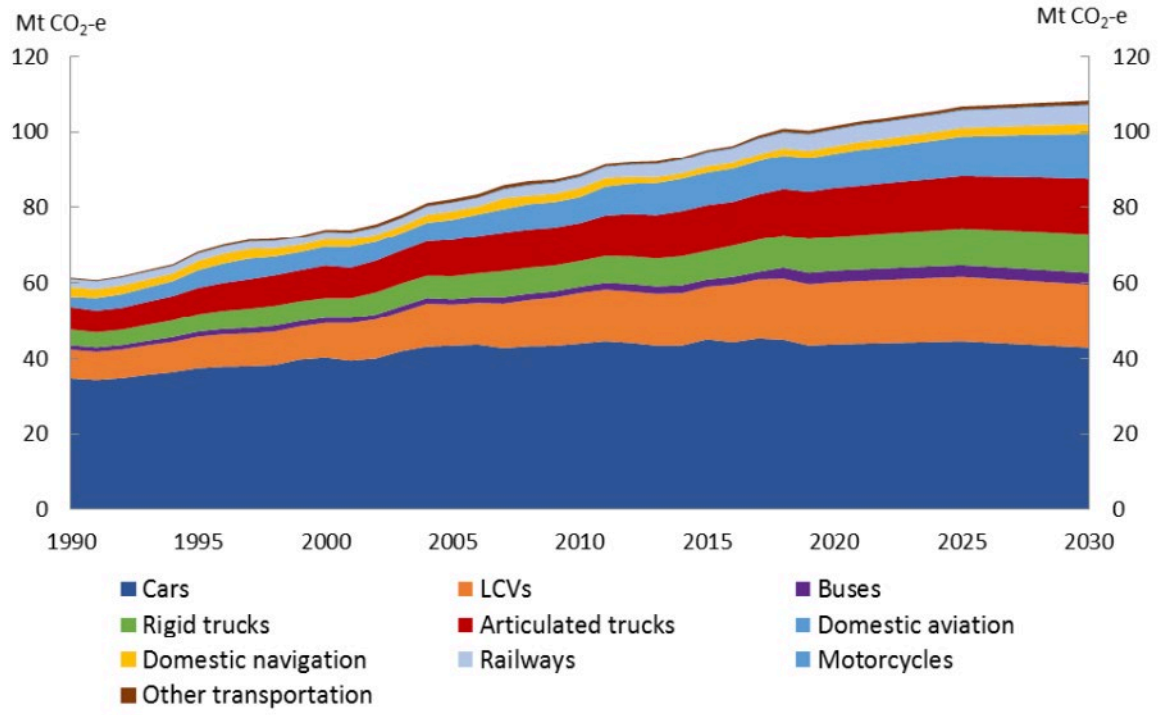
Projections of the energy sector (transport)

Emissions in the transport sector are the result of the combustion of fuels for transportation. This includes road, domestic aviation, rail, domestic shipping, off-road recreational vehicle activity and gas pipeline transport. Road transport includes cars, light commercial vehicles, motorcycles, rigid trucks, articulated trucks and buses.

Emissions from electricity used in electric vehicles and rail are accounted for in the electricity sector.

As Australia's population and economy has grown, transport activity and hence transport emissions have increased. This projection shows a stabilisation of emissions, especially from road transport, despite a growing economy, population and transport activity. The cause of this shift is improvements in engine efficiency and the emergence of electric vehicles.

Figure 5.4 Transport emissions, 1990 to 2030



Source: Department of the Environment and Energy 2019

Emissions trends

Transport emissions have grown since 1990 and are projected to reach 103 Mt CO_2-e in 2020. Over the projection to 2030 transport emissions continue to rise and then plateau around the mid-2020s. Transport emissions are projected to be 110 Mt CO_2-e in 2030, 7 per cent above 2020 levels.

The biggest contributor to emissions in the transport sector is road transport. Emissions from cars and light commercial vehicles are projected to increase to 2025 due to increased transport activity demands from a growing population, however from 2025 emissions start to decline. Increases in activity from 2025 to 2030 are more than offset by improvements in vehicle efficiency, fuel switching away from diesel and an increasing share of electric vehicles.

Passenger vehicles are the largest source of emissions within the transport sector. Over the projection period to 2030, emissions from passenger vehicles are relatively stable. Emissions from this source are projected to reach their highest point in 2025 and emissions are then projected to decline to 2030.

Emissions from non-road sectors are projected to grow to 2030 with most of the growth occurring in domestic aviation due to increasing demand for air travel. Emissions from domestic shipping and rail are projected to increase as they take on an increased freight load**.**

Methodology and assumptions

The Department of the Environment and Energy commissioned the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to undertake the modelling of *transport* emissions in 2018.

Modelling of transport emissions involves three models:

- the Adoption model
- the Demand model
- the Australian-TIMES (Aus-TIMES) model.

The Adoption model

The Adoption model takes vehicle costs together with demographic information to determine the future share of electric, fuel cell and autonomous vehicles. The model assumes that investment decisions are driven by a combination of price and non-price drivers so that adoption will broadly follow the consumer technology adoption curve. The adoption curve is calibrated to appropriate spatial scales (due to differing demographic characteristics and travel needs) and across different customer segments (fleet purchasing behaviour and vehicle utilisation).

The Demand model

The Demand model uses information around Gross Domestic Product, population, mode share and the cost of travel to determine projected activity for passenger and freight transport. Future mode share assumptions are developed based on observation of historical trends and consideration of the future of cities in Australia. This includes specific government programs to extend airports, rail and road infrastructure.

The Aus-TIMES model

The activity and sales of alternative vehicle projections from the Adoption and Demand models are then provided to the Aus-TIMES model which calculates least cost fuel and vehicle fleet changes to meet activity. AusTIMES is a partial equilibrium ('bottom-up') model, implemented as a linear program optimisation. The model has a robust economic decision making framework that incorporates the cost of alternative fuels and vehicles, as well as detailed characterisation of fuel and vehicle technical performance, including fuel efficiencies and emission factors by transport mode, vehicle type, engine type and age.

The Aus-TIMES transport model includes:

- coverage of all states and territories
- four broad transport modes: road, rail, aviation and shipping
- ten road transport modes: motorcycles; small, medium and large passenger cars; small, medium and large commercial vehicles; rigid trucks; articulated trucks and buses

- five road engine types: internal combustion; hybrid electric/internal combustion; hybrid plug-in electric/internal combustion; fully electric and fuel cell
- fourteen road transport fuels: petrol; diesel; liquefied petroleum gas (LPG); natural gas (compressed (CNG) or liquefied (LNG)); petrol with 10 per cent ethanol blend; diesel with 20 per cent biodiesel blend; ethanol and biodiesel at high concentrations; gas to liquids diesel; coal to liquids diesel with upstream CO2 capture; shale to liquids diesel with upstream CO2 capture, hydrogen (from renewables) and electricity
- all road vehicles are assigned a vintage based on when they were first purchased or installed in annual increments
- time is represented in annual frequency (2015, 2016 etc).

Table 5.5 Input and data sources for the transport sector model

Input	Data source
Fuel consumption	Table F of the Australian Energy Update 2019 (DoEE 2019c)
Oil prices	The oil price projections are informed by the Office of the Chief Economist and the United States Energy Information Administration (EIA 2019)
Gross Domestic Product	Department of the Treasury consistent with the Australian Government's 2019-20 Budget (Australian Government 2019)

Key outputs of the modelling include:

- fuel and engine technology uptake
- fuel consumption
- greenhouse gas emissions
- demand for transport services.

During 2019 separate analysis and modelling was commissioned from Keypath Consulting on the uptake of electric trucks and buses in Australia. The CSIRO results for fuel and technology uptake and greenhouse gas emissions were adjusted to incorporate these results.

The emission outcomes from the models were scaled to the latest inventory data.

Projections of the energy sector (fugitive emissions)

Fugitive emissions are released during the extraction, processing and transport of fossil fuels. Fugitive emissions do not include emissions from fuel combusted to generate electricity, operate mining plant and equipment or transport fossil fuels by road, rail or sea.

Emissions trends

Overall fugitive emissions from coal and oil and gas are projected to be 60 Mt CO_2-e in 2020, and decline over the period to 2030 by 1 per cent.

Fugitive emissions from coal are projected to be 26 Mt CO_2-e in 2020, 43 per cent of all fugitive emissions. Emissions are projected to increase to 29 Mt CO_2-e in 2030, 49 per cent of all fugitive emissions. The increase is mainly due to increased production of coking coal for export at underground mines.

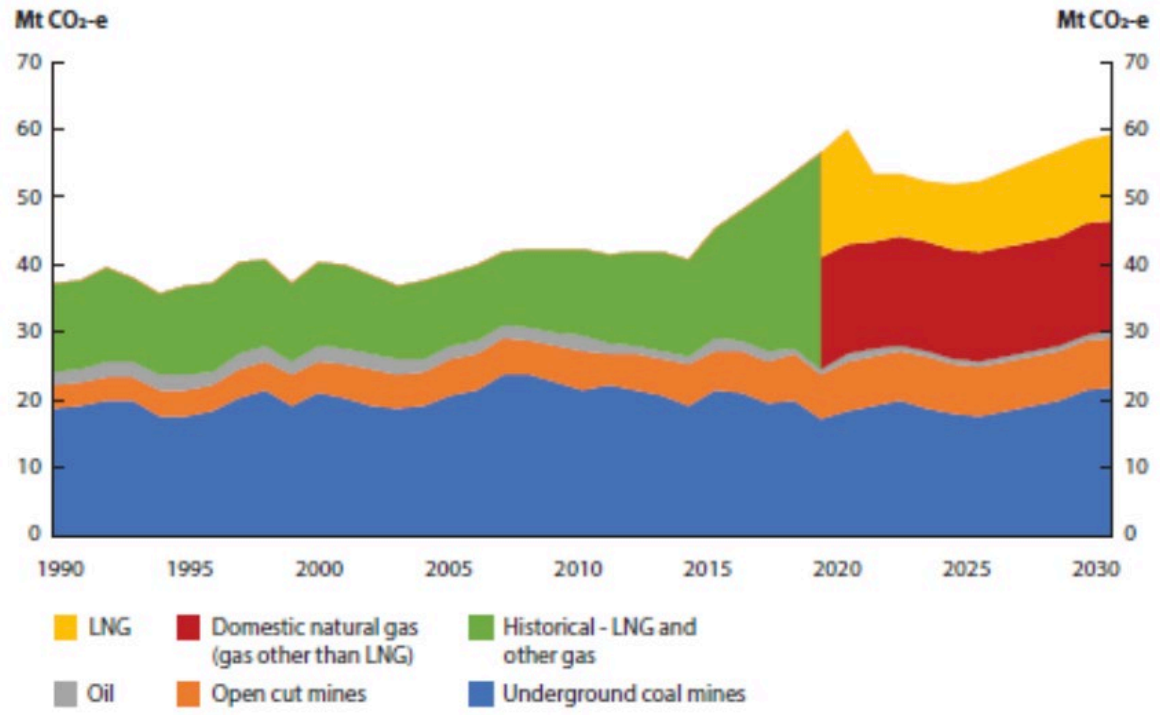
The primary drivers of emissions are the amount of coal produced, the emissions intensity of the mine and the amount of methane captured. There is wide variation in the gas content across Australian coal basins and across coal fields within the basins due to distinct geological and biogenic processes. This variability results in a small number of underground mines in the Southern, Hunter and Newcastle basins in New South Wales and the Bowen basin in Queensland having a large impact on total emissions. The largest ten emitting mines account for 53 per cent of fugitive emissions. Around 45 per cent of methane from underground coal mines is captured for flaring or for electricity generation.

Fugitive emissions from oil and gas are projected to be 34 Mt CO_2-e in 2020, 57 per cent of fugitive emissions. By 2030, emissions are projected to grow 13 per cent to 30 Mt CO_2-e, 51 per cent of fugitive emissions. This increase is primarily due to growth of Australia's LNG industry.

Fugitive emissions from LNG (i.e. liquefied natural gas for export) are projected to fall to the mid 2020s from the relatively high flaring emissions that occur in the initial years of new LNG projects. It is not expected that flaring emissions from projects will reach these levels again. Around the mid 2020s, emissions decline due to slowing LNG production. By the mid 2020s emission grow again as a facility returns from maintenance, additional capacity is assumed and some projects shift their feed gas to other basins, some with a higher CO_2 concentration.

Domestic natural gas and oil emissions remain broadly flat from 2020 to 2030.

Figure 5.5 Fugitive emissions, 1990 to 2030



Source: Department of the Environment and Energy 2019

Methodology and assumptions

Coal Fugitives

Operating Coal Mines

The Department maintains a mine-by-mine model of fugitive emissions from operating coal mines. A mine-by-mine model takes account of the emissions intensity of each mine which is dependent on the operational and geological characteristics of the mine.

$$E_t = \sum([P_{it} \cdot E_{li}]) - ERF/CSF_t$$

Where:
E_t = annual emissions from operating coal mines in year t (Mt CO_2-e)
P_{it} = coal production at minei, in year t (kt)
E_{li} = the emissions intensity of production at minei, (Mt CO_2-e/kt coal)
ERF/CSF_t = abatement from forthcoming Emission Reduction Fund and Climate Solutions Fund projects in year t (Mt CO_2-e)

The emissions intensity of coal mines includes all sources of fugitive emissions from vented methane and carbon dioxide, flaring and post mining. For operating mines the emissions intensity is sourced from the latest national greenhouse gas inventory data which is based on company data reported under the National Greenhouse and Energy Reporting scheme. For prospective coal mines, the emissions intensity is sourced from Environmental Impact Statements or is the average for currently operating mines in the same coal basin.

The Emissions Reduction Fund and Climate Solutions Fund can contract abatement from coal mine waste gas capture projects. Abatement from projects are subtracted from the coal fugitives projection.

Mine-by-mine production estimates for existing and new mines are sourced from Government and nonGovernment experts. Production is separately estimated for thermal and coking coal production at each mine.

Production from prospective new mines is scaled down so that growth in Australian coal production is consistent with International Energy Agency (IEA) estimates. The IEA supplies the Department with projections of Australian thermal and coking coal production consistent with the Stated Policies Scenario in the *2019 World Energy Outlook*. All prospective coal mines are scaled back at an equivalent rate, the projections do not make decisions on which prospective mines would and would not proceed. Scaling is undertaken for thermal and coking coal separately.

Production from brown coal mines is sourced from the *electricity sector* model.

Abandoned Coal Mines

Emissions are estimated using a mine-by-mine model developed for the national greenhouse gas inventory. The model is extended to include projected closures of underground coal mines to 2030.

The model requires the emissions at the time of closure, the mine type, mine void size and mine water inflow rates. Closure timing is informed by mine-by-mine projections provided by the Office of the Chief Economist (OCE) and AME Group and is consistent with the operating coal mines model. Emissions at the time of closure and mine void volume are sourced from the operating coal mines model. Emission decay curves are calculated from the formulas published in the *National Inventory Report*. Mine flooding rates are estimated based on the mine's water production region consistent with the national greenhouse gas inventory.

Oil and Gas Fugitives

Fugitive emissions from oil

The oil fugitive emissions projections are separated into five subsectors:

- Refining;
- Flaring;
- Production;
- Exploration; and
- Transport.

Modelling approach

Oil fugitive emissions projections are calculated using the following algorithm:

$$E_t = E_t\text{-}1 \,.\, Pr_t / Pr_t\text{-}1$$

Where:
E_t = *emissions in the year t (Mt* CO^2*-e)*
E_{t-1} = *emissions in the year t-1 (Mt* CO_2*-e)*
Pr_t = *proxy indicator in the projection year*
Pr_{t-1} = *proxy indicator in the year t-1*

Activity data

Activity data used to estimate emissions from oil and gas fugitives is provided in Table 5.6.

Table 5.6 Summary of sources for oil and gas fugitive emissions

Fugitive emissions source	Proxy indicator	Source
Oil refinery	Refinery output	OCE 2019a
Oil - flaring	Crude oil and condensate production	OCE 2019a
Oil - production	Crude oil and condensate production	OCE 2019a
Oil - exploration	Historical 10-year average of emissions from oil exploration	DoEE 2019d
Oil - transport	Crude oil and condensate production	OCE 2019a

Oil exploration emissions are small (<0.03 Mt CO_2-e) and volatile from year-to-year. A consistent link to a proxy indicator was not found. Therefore historical emissions levels have been used to project future emissions from this source.

Fugitive emissions from LNG

Modelling approach

The Department maintains a facility-by-facility model of fugitive emissions from LNG. Emissions depend on the operation of the plant, the carbon dioxide concentration and source of the feed gas, abatement actions and annual production.

$$E_t = \sum (P_{ti} \cdot (EI_{vi} + EI_{fi} + EI_{oi})) - CCS_{ti}$$

Where:
E_t = *LNG fugitive emissions in year t (Mt CO_2-e)*
P_{ti} = *production at facility i in year t (Mt LNG)*
EI_{vi} = *venting emissions intensity at facility i (Mt CO_2-e/Mt LNG)*
EI_{fi} = *flaring emissions intensity at facility i (Mt CO_2-e/Mt LNG)*
EI_{oi} = *other leaks emissions intensity at facility i (Mt CO_2-e/Mt LNG)*
CCS_{ti} = *CO_2 captured and stored at facility i in year t (Mt CO_2)*

Emissions intensities for venting, flaring and other fugitive leaks at operating facilities are based on NGER data. For new facilities emissions intensities are sourced from Environmental Impact Statements or other sources. The projected emissions intensities take account of changes in feed gas source.

Activity data

Production projections of each facility are informed by estimates from the OCE, AME Group and Wood Mackenzie. The projections consider committed and prospective additions and removals in capacity given the global outlook for LNG.

Fugitive emissions from domestic natural gas

Domestic natural gas is natural gas consumed in Australia. It is distinguished from LNG, which is predominantly produced for export. The small amount of LNG produced for domestic consumption is treated as domestic gas in the projections.

The sources of fugitive emissions from domestic natural gas in the projections are gas exploration, production and processing, transmissions, distribution, venting and flaring. Emissions are separated into twenty subsectors. Proxy indicators are used to project the growth in emissions at the state level from the subsectors as listed below.

$$E_t = E_{t-1} \cdot Pr_t / Pr_{t-1}$$

Where:
E_t = *emissions in the year t (Mt CO_2-e)*
E_{t-1} = *emissions in the year t-1 (Mt CO_2-e)*
Pr_t = *proxy indicator in the projection year*
Pr_{t-1} = *proxy indicator in the year t-1*

Table 5.7 Summary of sources for gas fugitive emissions

Fugitive emissions source	Proxy indicator	Data Source
Distribution	Unaccounted for gas losses	AEMO 2019b
Exploration - flared	Total gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Exploration - leakage - conventional	Conventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Exploration - leakage - unconventional	Unconventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Exploration - venting - completions - conventional	Conventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Exploration - venting - completions - unconventional	Unconventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Exploration - venting - workovers	Unconventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Processing	Total gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Production - offshore platforms	Number of shallow and deep offshore platforms	AME Group, Company Reports
Production - onshore gathering and boosting - conventional gas	Conventional gas production (excluding LNG)	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Production - onshore gathering and boosting - unconventional gas	Unconventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Production - onshore wells - conventional gas	Conventional gas production (excluding LNG)	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Production - onshore wells - unconventional gas	Unconventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Production - onshore wells - water production	Unconventional gas production	OCE 2019a, AEMO 2019b, AEMO 2019c, emission projections models for LNG, electricity
Transmission and storage - LNG terminals	Number of LNG terminals operating	AME Group, company reports
Transmission and storage - storage - LNG	Number of LNG storage stations operating	AME Group, company reports

Fugitive emissions source	Proxy indicator	Data Source
Transmission and storage - storage - natural gas	Number of gas storage stations operating	AME Group, company reports
Transmission and storage - transmission	Total pipeline length	AEC 2018, company reports, Department of the Environment and Energy expert advice
Venting and flaring - flaring - gas	Domestic gas consumption	AEMO 2019b, AEMO 2019c, emission projections models for electricity
Venting and flaring - venting - gas	Domestic gas consumption	AEMO 2019b, AEMO 2019c, emission projections models for electricity

Projections of the industrial processes and product use sector

The industrial processes and product use (IPPU) sector includes emissions from non-energy related production processes. Emissions from this sector include by-product gases from chemical reactions in production processes, the release of synthetic greenhouse gases from commercial and household equipment, combustion of lubricant oils not used for fuels, and carbon dioxide used in food and beverage production. Energy-related emissions are accounted for in the direct combustion sector.

Emissions trends

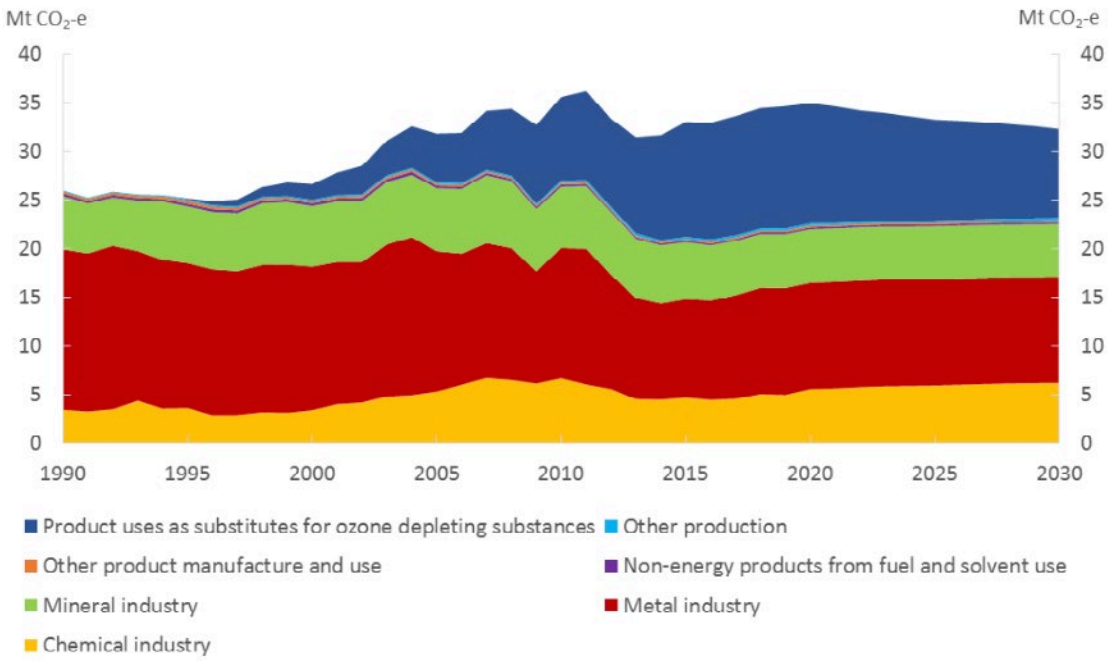
Industrial processes and product use emissions are projected to reach 35 Mt CO_2-e in 2020. Over the projections period, emissions will gradually decline reaching 32 Mt CO_2-e in 2030, 8 per cent below 2020 levels. Cumulative emissions from this sector are 334 Mt CO_2-e from 2021 to 2030.

Product uses as substitutes for ozone depleting substances, or hydrofluorocarbons (HFCs), is the largest source of emissions in the IPPU sector in 2020, contributing 12 Mt CO_2-e or 35 per cent of total emissions. Emissions from HFCs peaked in 2019 (13 Mt CO_2-e) and are projected to decrease to 9 Mt CO_2-e in 2030. Changes in emissions in the HFC sub-sector is main the driver for changes in the IPPU sector. The decrease in HFC emissions results primarily from the HFC phase-down implemented through the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* and associated Regulations.

The metal industry subsector is projected to remain steady across the projections period, contributing around 11 Mt CO_2-e each year. Following the projected decline in HFC emissions, the metal industry is projected to become the largest contributing subsector to IPPU emissions.

Chemical industry emissions make up 14 per cent of emissions in the IPPU sector in 2019, and are projected to increase by 1 Mt CO_2-e from 2020 to 2030, to 6 Mt CO_2-e. The main drivers for projected emission growth is the increased production forecasts for facilities producing nitric acid and ammonia.

Figure 5.6 Industrial processes and product use emissions, 1990 to 2030



Source: Department of the Environment and Energy 2019

Methodology and assumptions

Emissions from industrial processes and product use are prepared using bottom-up modelling approaches. Commodity production projections are estimated at the industry level and where appropriate, align with estimates prepared for the direct combustion sector. Production estimates are collected from, and informed by, a range of sources, including the Office of the Chief Economist, AME Group, IBISWorld, Merchant Research & Consulting Ltd, as well as desktop research conducted internally.

Emissions projections for the product uses as substitutes for ozone depleting substances and other product manufacture and use subsectors, are estimated by extrapolating models used in the preparation of the National Inventory Report. A detailed methodology for these subsectors is available in the National Inventory Report 2017.

Table 5.8 Summary of sources and formula for each IPPU subsector

Emissions subsector	Data source	Formula
Chemical industry		
Ammonia	Production data from Merchant Research & Consulting Ltd 2019	$E_t = \sum([U_{ji} \cdot EC_j \cdot EF_j])$ *Where:* E_t = annual emissions in year t (Mt CO_2-e) $U_{j,i}$ = natural gas consumption at facility$_i$ in year t EC_j = the energy content of natural gas EF_j = the emissions factor of natural gas
Nitric acid	DoEE estimates based on projected iron ore and coal production	$E_t = \sum([EF_i \cdot P_{it}])$ *Where:* E_t = annual emissions in year t (Mt CO_2-e) EF_i = facility-specific emissions factor P_{it} = annual nitric acid production at facility$_i$ in year t
Titanium dioxide Synthetic rutile	World GDP growth from the Organisation for Economic Co-operation and Development (OECD 2019)	$E_t = \sum([U_{jit} \cdot EC_j \cdot EF_j])$ *Where:* E_t = annual emissions in year t (Mt CO_2-e) U_{jit} = the use of fuel j at facility$_i$ in year t EC_j = the energy content of fuel$_j$ EF_j = the emissions factor of fuel$_j$
Acetylene	Population data from the Australian Bureau of Statistics 2018	$E_t = E_{t-1} \cdot \Delta$ Population *Where:* E_t = annual emissions in year t (Mt CO_2-e) $E_{,t-1}$ = emissions in the previous year Δ Population = percentage change in population between year t and year t-1
Petrochemical and carbon black	n/a	$E_t = E_{t-1}$ *Where:* E_t = annual emissions in year t (Mt CO_2-e) E_{t-1} = emissions in the previous year
Metal Industry		
Aluminium production	Production data from OCE 2019, OCE 2019a, and AME Group's industry analysis	$E_t = \sum([U_{jit} \cdot EC_j \cdot EF_j + (PFC_{t-1} * \Delta$ Production)]) *Where:* E_t = annual emissions in year t (Mt CO_2-e) U_{jit} = the use of fuel j as a reductant at facility$_i$ in year t EC_j = the energy content of fuel$_j$ EF_j = the emissions factor of fuel$_j$ PFC_{t-1} = perfluorocarbon emissions in the previous year Δ Production = percentage change in production between year t and year t-1
Iron and steel production	Production data from OCE 2019, OCE 2019a, and AME Group's industry analysis	$E_t = \sum([EF_i \cdot P_{it} - cs_{it}])$ *Where:* E_t = annual emissions in year t (Mt CO_2-e) EF_i = facility-specific emissions factor P_{it} = annual production at facility$_i$ in year t cs_{it} = annual deduction for carbon content in steel at facility$_i$ in year t

Emissions subsector	Data source	Formula
Ferroalloys production	Company statements	$E_t = \sum([U_{jit} \cdot EC_j . EF_j])$ Where: E_t = annual emissions in year t (Mt CO_2-e) $U_{jit,}$ = the use of fuel j as a reductant at facility$_i$ in year t EC_j = the energy content of fuel $_j$ EF_j = the emissions factor of fuel $_j$
Other metal production (copper, nickel, silicon and lead)	Production data from OCE 2019, OCE 2019a, and AME Group's industry analysis	$E_t = \sum([U_{jit} \cdot EC_j . EF_j])$ Where: E_t = annual emissions in year t (Mt CO_2-e) $U_{jit,}$ = the use of fuel j as a reductant at facility$_i$ in year t EC_j = the energy content of fuel j EF_j = the emissions factor of fuel $_j$
Mineral Industry		
Cement	Contextual production forecast from IBISWorld industry report	$E_t = \sum([EF_i \cdot P_{it}])$ *Where:* *E_t = annual emissions in year t (Mt CO_2-e)* *EF_i = facility-specific emissions factor* *P_{it} = annual production at facility$_i$ in year t*
Lime		
Limestone and dolomite and other carbonates	DoEE estimates based on projected ceramics, ferroalloy production, glass production, and iron and steel production. Zinc production data from OCE 2019a, and AME Group's industry analysis	$E_t = E_{t-1} * \Delta$ *Production* *Where:* *E_t = emissions in year t (Mt CO_2-e)* *E_{t-1} = emissions in the previous year* *Δ Production = percentage change in production between year t and year t-1*
Non-energy products from fuel and solvent use		
Lubricant use	n/a	$E_t = E_{t-1}$ *Where: E_t = annual emissions in year t,* *E_{t-1} = emissions in the previous year*
Product uses as a substitute for ozone depleting substances	DoEE 2019d	Based on *National Inventory Report* methodology
Other product manufacture and use		
Electrical equipment	DoEE 2019d	Based on *National Inventory Report* methodology
SF_6 and PFCs from other product uses	Population data from the Australian Bureau of Statistics 2018	$E_t = E_{t-1} . \Delta$ *Population* *Where:* *E_t = annual emissions in year t (Mt CO_2-e)* *$E_{,t-1}$ = emissions in the previous year* *Δ Population = percentage change in population between year t and year t-1*
N_2O from product uses		

Emissions subsector	Data source	Formula
Other production	DoEE estimates based on projected ammonia production and food, beverages & tobacco production	$E_t = E_{t-1} * \Delta$ *Production* *Where:* E_t *= emissions in year t (Mt* CO_2*-e)* E_{t-1} *= emissions in the previous year* *Δ Production = percentage change in production between year t and year t-1*

Projections of the agricultural sector

The agriculture sector includes emissions from biological processes associated with agricultural commodity production. This includes emissions from enteric fermentation (the digestive process of ruminant animals such as sheep and cattle), agricultural soils, manure management, liming and urea application, rice cultivation and field burning of agricultural residues. The bulk of agriculture emissions are methane and nitrous oxide.

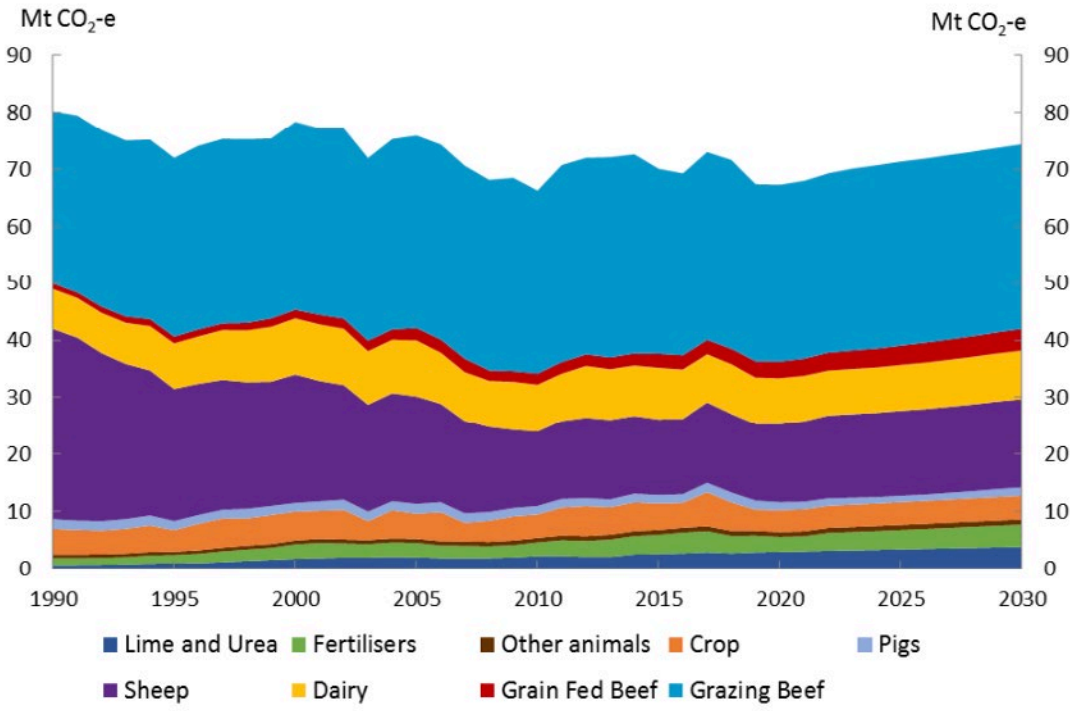
The agriculture sector does not include emissions from farm machinery or electricity use.

Emissions trends

Agriculture emissions are projected to be 67 Mt CO_2-e in 2020, the same as current levels, due to drought restricting growth in agricultural activities. Agriculture emissions are projected to be 74 Mt CO_2 -e in 2030, 11 per cent above 2020 levels, as agricultural activities return to average seasonal conditions.

Agricultural outputs have a strong dependence on short-term climate variations, with on-going drought conditions leading to elevated levels of cattle sold in the short-term. There is an increase in grain fed beef in feedlots due to these cattle historically being more drought resistant than grazing beef. Grain fed cattle are also more emissions intensive than grazing beef due to higher energy uptake and an increased concentration of manure in feedlots.

Figure 5.7 Agricultural emissions, 1990 to 2030



Source: Department of the Environment and Energy 2019

Methodology and assumptions

Emissions from the *agriculture sector are projected using bottom-up modelling developed by the Department. The model is maintained and updated within the Department using external inputs.*

Modelling approach

Emissions from agricultural activity is calculated as:

$$E_t = \sum_j \sum_l \sum_k \sum_i (N_{ki} . EF_{kjil}) \times 10^{(-3)}$$

Where

E = Emissions in year t (Mt CO_2-e)

Nki = quantity of activity type in each state, in relevant unit quantity (number of heads, kilotonnes, hectares, etc.)

EFkjil = emissions factors of gas types, by gas source

Emissions factors in:

(kt/unit of activity/year)

(Gg/unit of activity/year for rice cultivation)

Table 5.9 Symbols used in algorithms

Symbol	Variable	Variable categories
K^2	State	Australian Capital Territory, Northern Territory, Queensland, Tasmania, South Australia, NSW, Victoria, Tasmania
i^3	Activity type	Grazing beef cattle, grain fed beef cattle, dairy cattle, sheep, wheat, rice, etc.
j^2	Gas type	Methane, nitrous oxide, carbon dioxide
l^2	Gas source	Enteric fermentation, manure management, rice cultivation, agricultural soils, field burning of agricultural residues, lime and urea application

2 Different states, gas types and gas sources are not relevant to all activity types
3 Activity types may contribute a number of different gas sources

The agriculture projections use emissions factors for activity consistent with the *National Inventory Report. For formulas on calculating emissions intensity, please see the National Inventory Report.*

Activity data

Emissions are projected by calculating the amount of agricultural activity in Australia each year. This is done by drawing on external data sources that contain activity numbers and activity growth rates as summarised in Table 5.10.

Where activity data is not available for particular commodities, an appropriate proxy such as production (quantity of end product), or a relevant driver such as growth in another connected commodity (as informed by historical comparisons) is used. For example, nitrogen fertiliser use has increased in line with crop production. The assumption is that greater crop activity requires more nitrogen from fertilisers to support additional plant growth. Historical trends are also used to inform growth where projected activity data is unavailable.

The projections also include a trend towards grain-fed beef cattle, as some farmers seek a more drought resistant feeding system. This trend affects the emissions intensity of beef cattle production. Grain-fed is more emissions intensive than grass-fed, as diets of grain-fed beef cattle are more energy intensive. Animals convert a portion of this additional energy to emissions in the gut.

Units of agricultural activity (e.g. heads of cattle) are multiplied by relevant emissions intensities. Emissions intensity of activities are assumed to be constant across the projections period and equal to that reported in the final year of the *National Inventory Report*.

As emissions within agriculture relate to biological processes, as well as manure and residue management, individual commodities can contribute multiple types of emissions under IPCC subsectors.

Table 5.10 Summary of principle data source for Agriculture

Commodity	Data sources	Unit of activity
Lime and urea	DoEE estimate based on historical trends	Kilotonnes
Fertilisers	DoEE estimate based on historical trends	Kilotonnes
Other animals	Activity held constant at final year of inventory	Heads of animal
Other animals - poultry	ABARES 2019, ABARES 2019a OECD-FAO Agricultural Outlook 2019-2028	Heads of animal
Pigs	ABARES Commodities: March quarter 2019, September quarter 2019 OECD-FAO 2019	Heads of animal
Crops	ABARES 2019, ABARES 2019a CSIRO 2015 (CSIRO Land Use Trade-Offs (LUTO))	Non-rice crops: Kilotonnes of crop Rice: Kilotonnes of rice, Hectares of area under cultivation
Sheep	ABARES 2019, ABARES 2019a CSIRO 2015 (CSIRO LUTO)	Heads of animal
Dairy	ABARES 2019, ABARES 2019a CSIRO 2015 (CSIRO LUTO)	Heads of animal
Grain-fed beef	ABARES 2019, ABARES 2019a CSIRO 2015 (CSIRO LUTO)	Heads of animal
Grazing (grass-fed) beef	ABARES 2019, ABARES 2019a CSIRO 2015 (CSIRO LUTO)	Heads of animal

Projections of the waste sector

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

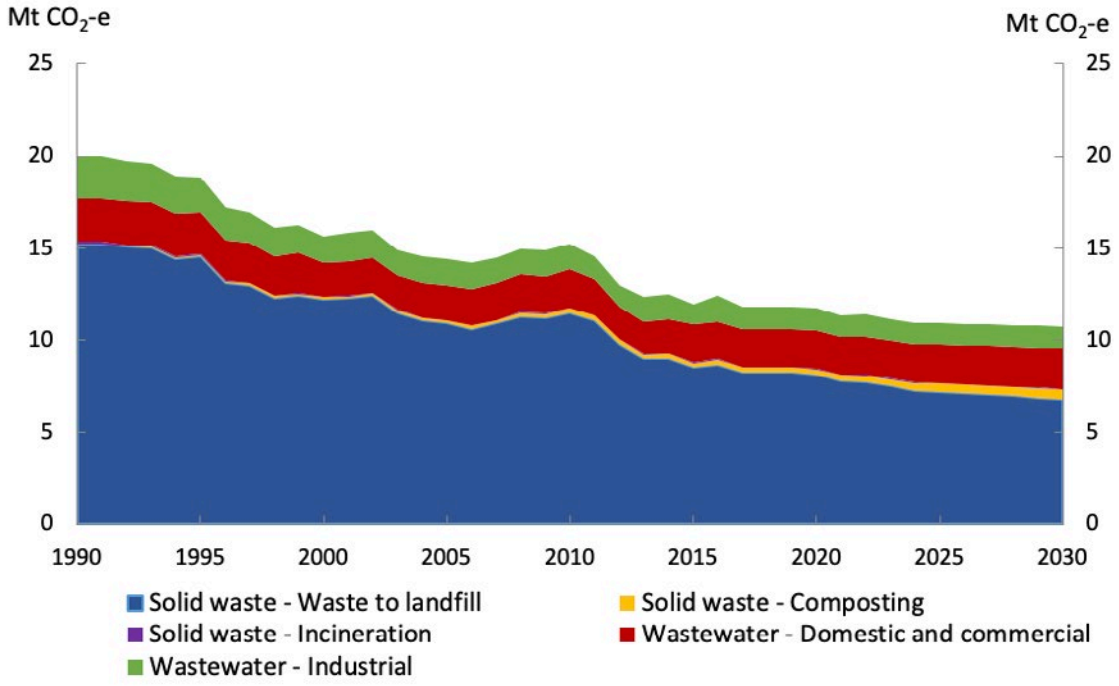
Emissions trends

Waste emissions are projected to be 12 Mt CO_2-e in 2020, the same as current levels. Waste emissions are projected to decline to 11 Mt CO_2-e in 2030 as a result of lower emissions from landfills driven by a decline in the amount of waste deposited and an increase in methane capture.

Emissions emanate from waste deposited at landfills over more than 50 years depending on the type of waste and the conditions at the landfill. Therefore changes in the type and amount of waste deposited impact the generation of emissions over an extended period.

A gradual decline in emissions from landfill is projected due to a forecast reduction in waste deposited at landfills, a declining proportion of food waste and a projected gradual increase in methane capture rates.

Figure 5.8 Waste emissions, 1990 to 2030



Source: Department of the Environment and Energy 2018

Methodology and assumptions

The Department of the Environment and Energy commissioned modelling from Blue Environment, supported by AECOM, for all waste emissions. The main drivers for emissions from each sub-sector are listed below.

The modelling replicated the methods for historical emissions applied in the National Inventory Report 2017. For the solid waste sector the modelling was completed on a site-specific basis to take account of the emission characteristics for individual landfills.

Solid Waste

For landfills, despite strong population growth, total disposal quantities have fallen slightly over the last decade due to declining per capita rates of waste to landfill which are expected to continue. Various levels of government in Australia set waste management targets. The projections take account of targets under the National Food Waste Strategy (50 per cent reduction in food waste per capita by 2030) and commitments made by state and territory governments to reduce waste generation and increase recovery.

Waste generation and recovery was projected to calculate landfill waste. Growth rates for nation-wide waste generation and recovery were extracted from modelling undertaken in support of the National Waste Policy. The stream growth rates were applied to waste generated in 2017-18 for each jurisdiction.

Methane recovery rates were projected to increase by 0.25 per cent per year to 2030. This rate of increase was based on a logarithmic trend of historical increases which is expected to continue.

Biological Treatment of Solid Waste

Policies at various levels of government in Australia are diverting organics from landfill to reduce landfill emissions and create market opportunities for organic waste products. Organic waste is treated through composting or anaerobic digestion.

Quantity of organic waste processed is projected for different sub-streams. The quantities of organic materials were assumed to change in proportion to changes in population or gross domestic product (GDP). Population growth rates were used to project quantities for organic materials generated mainly by people. These materials are garden organics, biosolids, oils, straw and others miscellaneous organics. GDP growth rates were used to project quantities for organic materials driven mainly by industry activity. These materials are commercial wood, sawdust, paunch and animal mortalities waste quantities.

Food waste was projected based on the National Food Waste Strategy target to reduce food waste landfilled by 50 per cent per capita by 2030. The model assumed reductions in food waste landfilled are diverted to biological treatment through improved collection services and processing facilities. The solid waste emission projections were used to calculate a national average of food organics landfilled per person (tonnes per capita).

Incineration

In Australia incineration emissions are generated from thermal oxidation of clinical waste and solvents. The model assumes clinical waste increases proportionately to population and the volume of solvents incinerated remains constant over the projections period.

Domestic and Commercial Wastewater

Emissions are estimated separately for sewered and unsewered population which have different assumed Chemical Oxygen Demand (COD).

The unsewered COD per capita ratio was applied to a projection of the unsewered population in each state and territory. Emissions were calculated based on the inventory methane emissions factor and the percentage of wastewater anaerobically treated (5 per cent).

The sewered COD per capita was applied to the population in each State and Territory. COD flows were used to estimate emissions from domestic and commercial wastewater facilities. COD influent refers to COD entering the wastewater facility in wastewater. COD outflows refers to:

- COD removed as sludge within the facility
- COD discharged from a facility as effluent, such as into rivers or the ocean
- COD in sludge removed to landfill or other land-based sites.

COD outflows were projected using ratios to COD influent. The ratios are a national average and based on the latest inventory data. COD outflows were projected for each state and territory using the calculated ratio and the COD influent for the relevant year. This approach assumes that the proportion of COD outflows to COD influent remains constant over the projection timeframe.

The methane generated was calculated using the following formulas:

- methane generated from wastewater = (COD influent – COD removed as sludge – COD discharged as effluent) x methane correction factor x methane emissions factor
- methane generated from sludge = (COD removed as sludge – COD removed to landfill or other landsite) x methane correction factor x methane emissions factor.

The proportion of methane recovered is held fixed from the latest inventory year.

Nitrous oxide emissions were calculated by replicating the same assumptions and calculations used to project methane from the sewered population. However, nitrous oxide emissions did not include any greenhouse gas recovery and are applied to the entire Australian population rather than to the sewered proportion.

Industrial Wastewater

Industrial wastewater emissions are projected for the following sub-sectors: dairy production; pulp and paper production; meat and poultry processing; organic chemicals production; sugar production; beer production; wine production; fruit processing; and vegetable processing.

Projections were based on changes to commodity production levels. Growth rates were based on long-term forecasts using sector-specific metrics.

Climate Solutions Fund

The solid waste and wastewater projections were adjusted to include additional abatement (e.g. capture of methane at landfills) induced by the Climate Solutions Fund that are additional to the business as usual scenario that was modelled.

Projections of the land use, land-use change and forestry sector

The land use, land use change and forestry (LULUCF) sector includes both sources of greenhouse gas emissions and sinks that remove carbon dioxide from the atmosphere and sequester it as carbon in living biomass, debris and soils. The most influential source of emissions is clearing of forests. Other land sector categories include the establishment and ongoing management of forests, grazing land, and croplands.

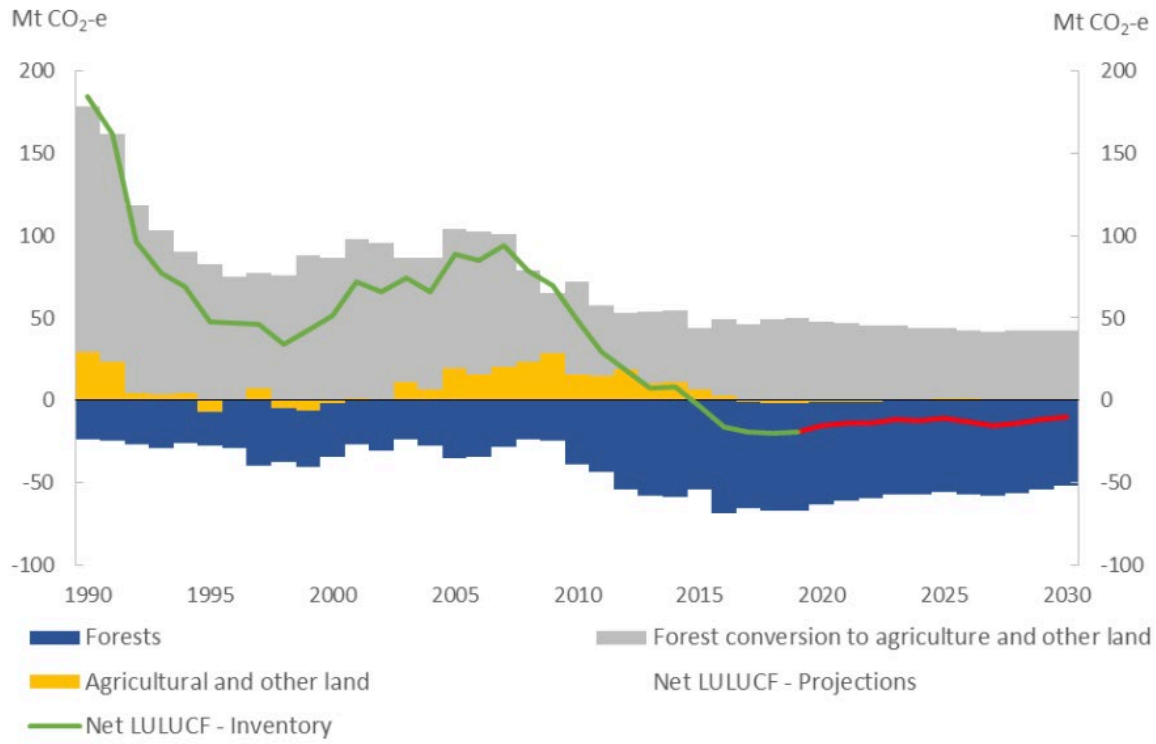
Emissions trends

LULUCF emissions have decreased since 1990 and are projected to reach -16 Mt CO_2-e in 2020. Over the projection to 2030 LULUCF emissions increase to -10 Mt CO_2-e in 2030 an increase of 37 per cent on 2020 levels, though the sector is still a net sink. One of the main drivers in the declining trend in LULUCF emissions over the past decade has been the decline in log harvesting activity in Australia's native forests.

The projections of emissions from harvested native forest is based on projected harvest rates published by ABARES. The ABARES harvesting projections showed harvesting falling slightly from current levels but staying around 4 million cubic metres per year.

The ABARES harvesting projections are the activity data used to drive the native forest sub-sector emissions projections model. The emission projection for this source shows the sink maintaining at around -30 Mt CO_2-e per year, reducing a little as the forests reach a mature phase when the rate of sequestration and emissions from the decay of debris begin to equalise.

Figure 5.9 Land use, land-use change and forestry emissions, 1990 to 2030



Source: Department of the Environment and Energy 2018

Methodology and assumptions

The Full Carbon Accounting Model (FullCAM) provides the modelling framework for estimating land sector emissions in the national inventory and the emissions projections. FullCAM models the exchange of carbon between the terrestrial biological system and the atmosphere in a full/ closed cycle mass balance model which includes all biomass, litter/debris and soil pools. The model uses data on climate, soils and management practices, as well as land use changes observed from satellite imagery to produce estimates of emissions and removals across the Australian landscape. For more information, a detailed description of the model is provided in Australia's National Inventory Report Appendix 6.B.

Key assumptions include:

- The forecast land clearing rates on forest lands converted to croplands and grasslands are assumed to return to historical levels before following the relationship between land clearing activity and the farmers' terms of trade, as described in Australia's National Inventory Report (Appendix 6.A.6 and 6.H).
- For projections of emissions from forest lands, log harvest forecasts were adopted from the 'business as usual' scenario published in the *Outlook Scenarios for Australia's Forestry Sector: Key Drivers and Opportunities*.

The projections include abatement from vegetation, soil carbon and savanna burning projects under the ERF and the Climate Solutions Fund by storing it as carbon on the land and by reducing methane and nitrous oxide released by fire.

For cropland and grassland emissions projections, management practices are assumed to remain unchanged over the projection period, and emissions to gradually return to long-run average conditions.

5.5 Projections of international bunker fuels emissions

Emissions from international bunker fuels result from fuel combusted for international aviation and international marine transport. Emissions from international bunker fuels are excluded from national inventory reporting, by international agreement.

International bunker fuels emissions incorporate historical data from Australia's National Inventory Report 2017 up to 2017. Emissions projections to 2030 utilise the historical annual growth rate from 2012 to 2017 for international aviation emissions. International maritime emissions projections are carried forward from the 2017 National Inventory estimate, keeping maritime emissions flat to 2030. International maritime bunker fuel emissions are variable, therefore a static value was chosen to represent a balance between soft growth in exports and efficiency gains in shipping.

In 2017, international bunker fuels generated 15 Mt CO_2-e of emissions. Emissions from international bunker fuels are projected to be 17 Mt CO_2-e in 2020 and 23 Mt CO_2-e in 2030. The majority of growth in emissions is due to an increase in the international aviation sector. Emissions from aviation are projected to be 15 Mt CO_2-e in 2020 and 21 Mt CO_2-e in 2030, rising at an average rate of 3 per cent per year.

Emissions from the marine bunkers sector accounted for 2 Mt CO_2-e of international bunker fuels emissions in 2019 and are projected to remain at 2 Mt CO_2-e in 2020 and in 2030.

5.6 Changes since Australia's 3rd Biennial Report

Since the Australia's Third Biennial Report, there have been updates to inventory data, revised sectoral trends, and the impact of current policies and measures in place, reflected in changes to 2020 projections across submissions (Table 5.11).

For the 4th Biennial report, the projections have been prepared using a combination of top down and bottom up sectoral models. Projections are prepared by the Department of the Environment and Energy analysts with assistance from external consultants for some sectors. The projections are prepared to 2030 using estimates of activity/production or activity growth based on publicly available data or data obtained from consultants. This data, with relevant and the most up to date emission factors, are used to calculate emissions.

For the 4th Biennial report, improvements have been made to the direct combustion and gas fugitive emissions sectoral models to enable projecting emissions at a more disaggregated level.

Further information on the assumptions and methodology for sectors can be found in Australia's Emissions Projections 2019 Report.

Table 5.11 Comparative sectoral breakdown of projections for 2020 under a 'with measures' scenario (UNFCCC accounting for LULUCF)

	Stationary energy[a]	Transport	Fugitives	IPPU	Agriculture	Waste	LULUCF	Total Emissions
2nd Biennial Report	300	103	46	34	80	10	21	593
7th National Communication / 3rd Biennial Report	280	101	51	34	75	10	-1	551
4th Biennial Report	274	102	60	35	67	12	-16	534

a Stationary energy includes emissions from the electricity and direct combustion sectors.

5.7 Uncertainty and sensitivity analysis

Emissions projections are inherently uncertain, involving expert judgement and assumptions about global and domestic economies, policies and technologies. Sensitivity analyses were prepared alongside the projections for certain sectors to assess how emissions are impacted by different economic and technology assumptions. Three sensitivities were undertaken:

- Low economic growth
- High economic growth; and
- Strong technology uptake.

No policy changes are assumed for different sensitivities, instead they represent a possible range of baseline scenarios for emissions projections to 2030.

Table 5.12 Sensitivity results compared to baseline, Mt CO_2-e

	2015	2020	2025	2030
Baseline	531	534	516	511
Low economic growth	531	524	466	422
High economic growth	531	539	569	580
Strong technology uptake	531	529	499	466

6. Finance, technology transfer and development, and capacity building

Australia continues to provide financial, technological and capacity-building support to developing countries to address climate change and its impacts, including supporting developing countries in pursuit of their international commitments. Australia recognises that sharing technological advances and information and assisting with building institutional and technical capacity is crucial in addressing climate change. Australia has been active in sharing its expertise with developing countries, with a strong focus on the neighbouring Indo–Pacific region.

Australia provided $274 million in total international climate assistance in 2016–17 and $324 million in 2017–18. This funding contributed to the commitment announced in 2015 to provide at least $1 billion over five years (2015–16 to 2019–20) to help developing countries in Australia's region build climate resilience and reduce emissions. The public financial support over the reporting period of 2016–17 and 2017–18 is summarised in the appendices (see CTF Table 7). CTF Table 7(a) provides information on public financial support through multilateral channels. CTF Table 7(b) provides information on public financial support through bilateral, regional and other channels.

The methodology Australia employs to track its climate finance expenditure is based on the agreed Organisation for Economic Development and Cooperation (OECD) Development Assistance Committee (DAC) statistical markers for climate change mitigation and adaptation. The methodology is tailored to Australia's development assistance program, reflecting the mix of modalities through which we deliver development assistance—bilateral, regional, global and multilateral programming.

Half of Australia's climate finance during the reporting period was attributed to the climate-specific component of bilateral, regional and global programs. The other half of the climate finance was channelled via multilateral organisations. Australia invests a significant proportion of its climate finance through multilateral development banks, where Australian funds leverage significant additional finance from other donors, the private sector, and partner countries using their domestic financial resources.

Australia recognises the need for further integration of climate change adaptation and disaster resilience and for stronger engagement with the private sector in finding solutions. As innovative and blended financing becomes more central to its overseas development efforts, Australia will develop systems and capability to track and report on non-grant financing instruments and private sector mobilisation in the context of Australia's climate finance.

Australia's climate finance in the reporting period was prioritised towards adaptation measures. Of Australia's support via bilateral, regional and global programs (i.e. excluding support via multilaterals, which is all classified as cross-cutting), 74 per cent of total climate-related expenditure contributed to adaptation, 18 per cent to mitigation and eight per cent was for cross-cutting activities. Australia prioritised assistance to countries most vulnerable to climate change, with two thirds of climate finance benefitting small-island developing states and least developed countries. Australia's climate finance was wholly grant-based and fully-expensed.

6.1 Key developments

With Australia's commitment to provide at least $1 billion in climate assistance to developing countries over five years (2015–16 to 2019–20), there has been a renewed focus on climate change support through Australia's development assistance program. Australia continues to provide support for developing countries to build climate resilience and reduce emissions, and is working to mobilise private sector support for the necessary global economic transition in line with Australia's international commitments.

Australia's *Foreign Policy White Paper (The White Paper)* released in November 2017 recognises climate change as one of the challenges that will continue to shape our world, with many countries in Australia's immediate region expected to be severely affected in the long term. The White Paper notes Australia has expertise in sustainable agriculture and cities, climate smart infrastructure, water management and climate finance that can be shared with development partners. It reiterates that responding to climate change will continue to be a priority for Australia's development assistance.

Consistent with The White paper, Australia's climate change assistance focuses on the Indo–Pacific region, notably Pacific island countries. Australia prioritises bilateral support to the most vulnerable Pacific countries and in 2016 Australia committed to spending at least $300 million over four years (2016–17 to 2019–20) on climate and disaster resilience support in the Pacific. Australia also provides modest support to South and West Asia and South East Asia, and support via global programs operating across multiple countries or regions.

Australia integrates climate action across aid policies and programs, as well as providing specific and targeted climate development assistance to support developing country partners' transition to lower-emissions, more climate resilient communities with better sustainable development outcomes. Australia's approach to support for climate change promotes social inclusiveness, with a clear focus on the most vulnerable communities, especially women and girls, people with disability and indigenous peoples. Australia's programs encourage the participation of these vulnerable groups and harness their expertise in finding solutions.

The OECD DAC's peer review of Australia's aid program (March 2018) noted Australia's advocacy for responses to unique challenges faced by small island developing states, and its effective use of regional and multilateral channels to exert influence to channel support to the Pacific. It recommended Australia strengthen its strategic approach to mainstreaming climate change considerations across the development assistance program, noting the risks for security and prosperity in the Pacific.

Australia is already integrating climate action across its development assistance program and policies. Australia's approach is to ensure that investments are effective, sustainable, climate-resilient and adequately address risk. In the reporting period, Australia further integrated climate change across the development assistance program by providing specific and tailored climate policy guidance to program managers. Australia also incorporated climate change into other departmental policies, for example the Department of Foreign Affairs and Trade (DFAT) 2016 Humanitarian Strategy, and has been working to improve aid quality and reporting systems. DFAT's new Environmental and Social Safeguards Policy, which came into effect in January 2018, mandates consideration of climate change-related risks in all overseas development assistance (ODA)-funded projects. Operational procedures and guidance notes help development assistance program staff incorporate climate change in relevant steps of the program management cycle.

The Australian Senate's Foreign Affairs, Defence and Trade References Committee released the *Implications of Climate Change for Australia's National Security* report, which explored the implications of climate change for Australia's national security in May 2018. The Committee supported Australia's efforts to align

development assistance with the priorities of partner countries and communities, focus on human security, and empower groups disproportionately affected by the impacts of climate change. The committee noted that climate finance is being embedded in existing development assistance programs, for example, by ensuring infrastructure projects such as roads are resilient to climate change impacts.

An evaluation of climate change effectiveness in Australia's development assistance program was conducted by the Office of Development Effectiveness, an operationally independent unit within DFAT that measures and reports on the effectiveness of the Australian aid program. The evaluation, published July 2018, identified opportunities to further improve the integration of climate change considerations across Australia's development assistance program. This led to a limited number of strategic recommendations in relation to longer-term direction setting and ambition. The evaluation identified key characteristics of stronger-performing climate change investments as having:

- longer investment timeframes (five years or longer)
- climate change risks framed within the broader development goals of partner countries
- scientific and technical partners with strong on-the-ground service delivery experience, and
- an appropriate level of technical input in design and implementation.

Australia draws on the evaluation findings and recommendations in considering how to best incorporate climate change in new and existing policies and programs.

6.2 Finance

Australia's aid policy, *Australian aid: Promoting prosperity, reducing poverty, enhancing stability* sets out the approach Australia takes to building resilience to climate-related shocks, including working with the private sector to increase Australia's impact, particularly in the Indo-Pacific region. Australia's assistance is demand-driven by partner governments and informed by rigorous country assessments. Australia has a focus on results which is reflected in the performance framework *Making Performance Count: Enhancing the accountability and effectiveness of Australian aid.*

Australia provided $274 million in total international climate assistance in 2016–17 and $324 million in 2017–18. This constituted around seven per cent of Australia's overall ODA expenditure for the reporting period, with around 20 per cent of projects (by value) incorporating a climate finance component. Australia's climate finance comprises dedicated climate-focused investments, as well as investments that integrate climate and disaster considerations as secondary objectives ('mainstreamed'). In terms its climate finance provision, Australia's current priorities include:

- Working with developing countries in the Indo-Pacific region to reduce their carbon emissions.
- Helping partner countries plan for, reduce the risk of, and adapt to climate change; which includes building resilience and managing climate change impacts, taking into account vulnerable groups.
- Supporting opportunities to increase climate finance investments by the private sector in the Indo–Pacific region, given the key role played by the sector in partner countries' transitions to low-emissions, climate resilient economies.
- International cooperation to support the sustainable ocean economy and healthy oceans, to protect and restore ecosystems that store carbon, underpin livelihoods, or protect coastal areas against extreme weather events.

Australia's investments over the reporting period build on earlier investments that support effective, evidence-based adaptation and that strengthen governance across key sectors including finance, infrastructure, education, water and food security. Australia's support also builds the capacity of Pacific island countries and least developed countries in Indo–Pacific region to access climate change financing to attract investment.

Australia's climate change support is delivered largely through the development assistance program, administered primarily by DFAT in partnership with other federal and state government agencies, including the Department of the Environment and Energy, CSIRO, the Bureau of Meteorology, and the Australian Centre for International Agricultural Research (ACIAR). Australia works with a range of non-government partners to find new ways to increase all sources of finance for climate-related programs, including the private sector, academia and research and learning institutions.

Australia works with a range of other organisations. This includes the Commonwealth Climate Finance Access Hub which improves access for small and vulnerable Commonwealth countries to climate finance by placing long-term advisers at national and regional levels within small states and least developed countries to support efforts to access and effectively use international climate finance. Australia also works with the multi-donor Private Financing Advisory Network to identify promising clean energy and climate businesses in developing countries and provide mentoring, network and technical assistance to help secure private finance.

National approach to tracking and reporting climate finance

DFAT is responsible for accounting Australia's climate finance. Australia's method for tracking climate finance varies depending on modality, namely:

1. bilateral, regional or global activities where the investment is targeted at climate change mitigation or adaptation, or the investment integrates climate in its implementation
2. core contributions to multilateral development banks and multilateral funds, and
3. other official flows related to climate change.

Australia's climate finance reporting complies with OECD and UNFCCC standards. In May 2018, the UNFCCC coordinated a team of international experts which conducted a review of the climate finance information provided by Australia in its Seventh National Communications and Third Biennial Report. The review team found Australia's reporting to be complete, transparent and in adherence with UNFCCC reporting guidelines.

Australia tracks its ODA expenditure primarily through its development assistance program management system (Aidworks), in conjunction with specific databases for the Australia Awards, Australian Volunteers and Australian Non-Government Organisation (NGO) Cooperation programs. The collected data is subsequently verified with program managers.

For bilateral, regional and global programs, Australia assesses each activity to determine if it has an explicit climate change objective (based on OECD DAC guidance) and whether this is a primary or secondary objective. Australia also assess whether each individual activity contributes to adaptation, mitigation, or both. Where climate change is the primary objective, 100 per cent of the activity value is counted as climate finance. Where climate change is a secondary objective, an estimate is made of the amount spent on delivering climate results. If a dollar value cannot be calculated, a figure of 30 per cent of the activity value is used. This information for all bilateral, regional and global programs is then aggregated to derive the figures reflected in CTF Tables 7 and 7(b).

It should be noted that most country and regional programs, and the portfolio of global programs, contain a mix of mitigation and adaptation activities reflecting best practice program design. Hence, CTF Table 7(b) lists the type of support as 'cross-cutting' in many cases. When Australia's online CTF Table 7 is produced, it automatically aggregates all 'cross-cutting' entries to produce the total expenditure for bilateral, regional and global programs. However, CTF Table 7 reflects the aggregation of the underlying activity-level information to calculate the actual total expenditure for each category of adaptation, mitigation and cross-cutting support. This has been done to maximise transparency and present a more accurate picture of Australia's climate finance.

Australia counts a percentage of the nation's core contributions to multilateral development organisations according to the imputed shares calculated by the OECD DAC. Where climate change is the primary focus of the institution (e.g. the UNFCCC), Australia counts 100 per cent of the core contribution as climate finance. Where climate change is one of several work areas of the institution (e.g. the World Bank), only a portion of the nation's contributions are counted as climate finance. While Australia makes core contributions to some UN agencies which likely include climate change activities—for example, the United Nations Development Programme—the OECD DAC does not currently calculate imputed shares for all UN agencies. In such cases, Australia does not count a portion of its core contribution as climate finance because there is no robust internationally agreed calculation method. The most recent available imputed shares (as at 19 November 2019) have been used, as follows:

Table 6.1 Distribution of Australia's Climate Finance Contributions

Organisation	Coefficient applied
Green Climate Fund	100%
Multilateral Fund for the Implementation of the Montreal Protocol	100%
IPCC	100%
UNFCCC	100%
Global Green Growth Institute	98.98%
Global Environment Facility Trust Fund	65.65%
World Bank—International Development Association	21.68%
Asian Development Bank—Asian Development Fund	15.42%
Asian Infrastructure Investment Bank	42.19%

Part of Australia's support to developing countries for climate action derives from sources other than development assistance. This support is tracked by the relevant Australian government agency administering the program. Where the investment targets climate change mitigation or adaptation as a principal objective of the non-ODA investment, Australia counts 100 per cent as climate support. Although Australia makes climate finance investments through other official flows where climate change is not the principal objective, these are not currently counted towards Australia's climate finance. We will consider including other official flows where climate change is mainstreamed into the investment as more robust methods become available.

Multilateral support

Australia engages with multilateral organisations to capitalise on their resources, geographic reach and technical expertise and to achieve greater, more cost effective impact. Half (50 per cent) of Australia's climate finance during the reporting period comprised the climate components of Australia's core contributions to multilateral organisations, which support climate change activities globally. This included core contributions to multilateral development banks, such as the Asian Infrastructure Investment Bank, World Bank, and Asian Development Bank, and contributions to multilateral climate and environment funds, including the Green Climate Fund, Global Environment Fund and the Global Green Growth Institute.

Over 2016–17 and 2017–18, Australia provided $301 million in climate financing support to developed countries through multilateral organisations, comprising:

- $70 million to the Asia Infrastructure Investment Bank
- $82 million to the World Bank
- $50 million to the Asian Development Bank
- $55 million to the Green Climate Fund
- $26 million to the Global Environment Facility Trust Fund
- $12 million to the Multilateral Fund for the Implementation of the Montreal Protocol
- $3.8 million to the Global Green Growth Institute
- $2 million to the UNFCCC and Kyoto Protocol
- $0.6 million to the IPCC.

Full details are contained in CTF Table 7(a).

Bilateral, regional and global

Australia takes a partner country-driven approach to the delivery of support for mitigation and adaptation efforts. Australia's bilateral climate support relationships are administered through partnership agreements, which ensures Australia's assistance targets, partner countries' priorities and climate finance needs are reflected in Nationally Determined Contributions, National Adaptation Plans and national development plans.

Australia's bilateral, regional and global programs focus on assistance to countries most vulnerable to climate change and support is prioritised towards adaptation measures. Two thirds (66 per cent) of Australia's climate finance via bilateral, regional and global programs benefits small island developing states and least developed countries. Seventy-four per cent of climate finance expenditure contributed to adaptation, 18 per cent to mitigation and eight per cent was for cross-cutting activities.

In 2016–17 Australia's total bilateral, regional and global spend was $152 million, and in 2017–18 it totalled $145 million. This is approximately half Australia's total climate finance. Full details are contained in CTF Table 7(b).

In the Pacific, Australia complements bilateral activities with support for regional approaches that are developed through the Pacific Islands Forum and other regional organisations, such as the Framework for Resilient Development in the Pacific and the Pacific Resilience Partnership. Australia's support includes

dedicated initiatives aimed at strengthening resilience, as well as a comprehensive effort to integrate climate and disaster risks into all areas of the Pacific development assistance program.

For example, in the reporting period Australia's Fiji Program Support Facility Preparedness and Response Fund built civil society organisations' capacities in disaster risk reduction to reduce vulnerabilities and resilience to impacts of climate change. Another example is seen in in Tuvalu, where Australia is helping the Tuvaluan Government include responses to climate change in the National Constitution and build their capacity to access and use international climate finance.

In South East Asia, Australia's climate development assistance is a mix of investments that target climate change adaptation and mitigation and investments that embed climate change considerations in programs in key sectors such as infrastructure, water, agriculture and governance. An example of this is seen in the Australia Indonesia Partnership for Rural Economic Development, which builds resilience and reduces emissions in the agriculture sector, including through the introduction of dry land farming practices, use of drought resistant seed varieties and support for water efficient irrigation. Another example is Australia's work in Cambodia, which incorporates climate change considerations in the development of irrigation schemes, supports renewable energy, and helps farmers to diversify by choosing climate change resilient crops.

In South and West Asia, Australia's climate development assistance focuses on climate action in energy, water and agriculture sectors. For example, in the reporting period, the Sustainable Development Investment Portfolio supported integrated water, energy and food management in three major Himalayan river basins, with a focus on climate change risks. Activities include development of flood forecasting and early warning systems, and the design of climate-resilient hydropower developments.

Global programs deliver activities across multiple countries or regions. For example, the Australian NGO Cooperation Program provides annual grants to accredited Australian NGOs to support their projects in developing countries. These projects span a range of sectors, including education, health, water and sanitation, food security and economic development. A portion of these projects incorporate climate change objectives, and this are reported as 'global' programs. As another example, Australia contributes to the World Bank-led Global Facility for Disaster Reduction and Recovery. The Facility is helping developing countries reduce their vulnerability to natural hazards by enabling countries to design and implement comprehensive approaches to disaster risk management, and helping embed resilience into development policies and plans. A portion of Australia's contribution to the Facility is captured in the 'global' category.

Private sector

Australia recognises that public finance alone cannot deliver the trillions of dollars in investment required annually for the global transition toward low-emissions and climate-resilient development. Mobilisation of private finance is critical to delivering the US$100 billion by 2020 climate finance goal, as well as the 2030 Agenda for Sustainable Development. Australia is exploring new ways to mobilise private sector capital at scale, through policies and enabling environments, stronger financing instruments and smarter use of public finance to mobilise private sector capital.

Australia recognises developing countries can experience challenges in attracting and gaining access to private finance for climate action, particularly in the Pacific. Australia has been increasing efforts under its development assistance program to identify opportunities to improve enabling environments and develop investment-ready projects to facilitate greater private finance in the Indo–Pacific. For example, during the reporting period Australia has:

- Supported the Private Financing Advisory Network (PFAN), which coaches climate and clean energy small businesses in developing countries until they are investment-ready and then links them to investors. With Australia's support, PFAN is expanding its work in the Indo–Pacific. Australia provided $2.65 million to PFAN in 2016–17 and $1.35 million in 2017–18. Australia also serves as the Vice-Chair of the PFAN Steering Committee.
- Provided matching finance for clean energy projects under DFAT's Business Partnerships Platform. For example, Australia has committed $500,000 to a joint investment with Digicel for affordable and reliable solar energy in PNG (2016–2018).
- Used public funding to support the broader transformation of finance flows needed to implement the Paris Agreement. For example, Australia committed $4.60 million in 2016–17 and $3.95 million in 2017–18 to the Private Infrastructure Development Group which identifies, develops and mobilises private investment, including providing guarantees for clean energy projects in developing countries.
- Facilitated partnerships between domestic actors and international climate finance vehicles to accelerate mobilisation of climate finance. In 2016–17 and 2017–18, Australian officials met with a range of domestic actors from the private sector, government and non-government organisations to share expertise, establish critical relationships, and promote new initiatives and better ways of working together.

In 2019, Australia announced a new $140 million Private Sector Mobilisation Climate Fund which will accelerate climate action in the Indo–Pacific by increasing the pace and scale of private sector climate investments.

To date, Australia has not counted private sector investment leveraged by the government's investments towards the nation's climate finance contribution. Australia continues to work with partners on methods for tracking leveraged private sector investment. This includes through ongoing engagement in the OECD Climate Change Experts' Group (CCXG), which aims to promote dialogue among developed and developing countries on technical issues in international climate change negotiations. Australia will work towards reporting private sector investment leveraged in future years.

6.3 Technology transfer and development

Australia is committed to supporting the development and transfer of climate technology to assist countries meet their mitigation and adaptation commitments. The development and transfer of technology is embedded in much of Australia's climate finance, with many projects expanding access to technology which supports lower-emission, climate resilient development. Australia is also active in a range of international technology-based partnerships and programs aimed at accelerating the development and diffusion of climate-friendly technology.

Australian support for technology development and transfer encompasses help to achieve both adaptation and mitigation across a number of key economic sectors for partner countries. As well as projects which directly provide new technological advancements to partner countries, many projects help foster innovation and build enabling environments which encourage the use of lower-emission, climate resilient technologies.

Australian support has helped partner countries to increase their share and use of low-emission electricity generation technologies in line with their development needs and their climate commitments. For example, in the Solomon Islands, Australia has supported the Tina River Hydropower project through the World Bank Group. This investment supports the preparation phase of the project, which will convert a major proportion of Honiara's energy supply from diesel-based to hydro and enable the Government to meet its renewable energy targets.

In the agricultural sector, Australian support has helped the transfer of climate technologies to smallholder farmers to increase their productivity, improve their resilience and reduce their greenhouse gas emissions. For example, in Vietnam through the AgResults program, Australian support for the Vietnam Greenhouse Gas Emission Reduction Pilot has identified novel approaches for reducing greenhouse gas emissions while increasing yields in rice cultivation, scaling up the most effective approaches to thousands of smallholder farmers.

Australian projects also support the development of enabling environments which encourages the use of climate technologies in development projects in line with environmental and social guidelines. For example, in the Mekong region, Australia is supporting a program on sustainable hydropower development which includes regulatory and technical guidelines development, water law revision, strategic environmental and social assessment. This is designed to ensure Mekong countries can encourage the use of climate technologies in future energy projects.

Australia is working in developing countries to ensure that infrastructure projects are resilient to the challenges of a changing climate. In Vanuatu, for example, the Port Vila Urban Development Project is designing and building roads and drainage that take into account increased rainfall intensities as a result of climate change. In the Solomon Islands, transport infrastructure projects aim to 'build back better', including through rebuilding key infrastructure destroyed in a cyclone in ways which will meet future climatic conditions.

Technology development and transfer measures undertaken in the reporting period are detailed in CTF Table 8. Although this is not an exhaustive list, it still demonstrates the wide range of activities Australia supports which include the development and transfer of technology.

6.4 Capacity building

Capacity building support is provided to developing countries to assist them in meeting their international commitments. Australia supports institutional and technical capacity of partner countries in the Indo–Pacific region to support their domestic climate change priorities as articulated in their national planning documentation. Australia shares its capabilities and supports local efforts in country, including in areas where we have expertise and which underpin effective responses to climate change. These areas include climate science and meteorology, energy, water, agriculture, infrastructure, adaptation, disaster preparedness and response. Australia supports scientific, policy and institutional capacity building, drawing on the expertise of agencies such as CSIRO, Bureau of Meteorology, ACIAR, DFAT and the Department of the Environment and Energy. In doing so, Australia is able to assist partner countries create mitigation and adaptation policies, build systems to measure and report on emissions and engage effectively in climate change negotiations.

Australia recognises that often the most important contribution donors can make is to support developing countries take ownership of their mitigation and adaptation agendas. This is mostly done by helping to build domestic know-how and expertise. Australia acknowledges that climate finance investments are more sustainable and effective when the approach to delivery of support is country-driven.

Australia assists developing country partners in measurement reporting and verification (MRV) systems for emissions reductions and management. MRV systems are an essential foundation of developing countries' climate change mitigation efforts, enabling them to identify and track sources of emissions and develop pathways for international transfers of units. For example, under the Australia Indonesia Partnership for Environmental Governance, Australia's Department of Environment and Energy is working with Indonesia's Ministry of Environment and Forestry to improve Indonesia's capacity for the MRV of

greenhouse gas emissions. It is also piloting new technology to provide information for use in demonstrating action against Indonesia's Nationally Determined Contribution.

Australia is also helping other countries in our region develop their capabilities in MRV, through bilateral technical engagements with Papua New Guinea, Fiji and Thailand, and by influencing global forums such as the Global Forest Observations Initiative and the Forest Carbon Partnership Facility.

Australia places considerable focus on capacity building for the Pacific, both via bilateral and regional activities, across adaptation and mitigation. For example, in the reporting period, Australia's Growth and Economic Management program in Kiribati built skills and capacity to mainstream climate change into the Kiribati Development Plan. Australia also provided strategic and technical support to the Director of Climate Finance position in the Ministry of Finance to help Kiribati access and manage climate finance. In Tonga, Australia's Outer Islands Renewable Energy Project included considerable capacity building via training staff in Tonga's utility company to install and maintain renewable energy systems on remote outer islands, as well as training line technicians to service local renewable-driven grids. At a regional level, the Climate and Oceans Support Program in the Pacific, implemented by the Australian Bureau of Meteorology, supported 14 Pacific meteorological services to monitor, analyse and communicate information about climate and oceans, including seasonal forecasts and sea level rise.

Australia recognises the importance of protecting and restoring ecosystems to reaching global climate goals. The Australian Government, through the Department of the Environment and Energy leads two international capacity building mitigation programs that promote the protection and restoration of coastal and rainforest ecosystems:

- The International Partnership for Blue Carbon is considered the leading international policy platform for blue carbon, since its establishment in 2015, aiming to build awareness, share knowledge and accelerate practical action to protect and restore blue carbon ecosystems (mangroves, tidal marshes and seagrasses). The partnership has achieved high-level support from governments, research institutions and non-government organisations with 41 global members (15 countries, ten non-governmental organisations and 16 intergovernmental or research organisations).
- The Asia-Pacific Rainforest Partnership is an Australian-led initiative that builds connections between governments, the private sector, and civil society to promote greater action to reduce emissions from deforestation in the Asia-Pacific region, including supporting countries to develop forest monitoring systems and ability to access international climate finance. Through this partnership, Australia works with developing countries to help them measure, manage, and unlock the significant abatement potential and adaptation benefits from the land sector.

In 2016–17 and 2017–18 Australia continued its funding for a program to train women leaders and build the capacity of twelve Pacific Island nations' delegations to advocate for climate policies. The Pacific Women Climate Change Negotiators' Training program trained participants in diplomacy and negotiation skills and climate change negotiations, and contributed to the development of leadership skills, providing connections and networking with other women leaders. This ongoing program enables women leaders from the Pacific, at the frontlines of climate impacts, to also serve effectively on the frontlines of climate change policy-making and implementation.

CTF Table 9 details some of the capacity building measures undertaken during the reporting period. Although this is not an exhaustive list, it does demonstrate the wide range of activities we support designed to build capacity.

7. Other reporting requirements

7.1 Institutional Arrangements

The Administrative Arrangements Order sets out policy responsibilities for Australian Government Departments. Under this Order the Australian Department of the Environment and Energy is responsible for climate and energy matters and all related legislation.

Australia's policies and measures are developed based on expert advice and continuous consultation with industry and the community. Policies are implemented within strict governance frameworks and often by independent bodies, such as the Clean Energy Regulator (CER).

As reported in the Seventh National Communication and above, the CER is an independent statutory authority established under the *Clean Energy Regulator Act 2011*. The CER is responsible for administering legislation to reduce carbon emissions and increase the use of clean energy in Australia. This includes the National Greenhouse and Energy Reporting scheme and the Safeguard Mechanism, the Renewable Energy Target, the Emissions Reduction Fund and the Australian National Registry of Emissions Units.

Independent bodies may be established to manage financing of projects under a policy. The Australian Government established the Australian Renewable Energy Agency under the *Australian Renewable Energy Agency Act 2011*, to accelerate Australia's shift to an affordable and reliable renewable energy future. The Clean Energy Finance Corporation, established under the *Clean Energy Finance Corporation Act 2012*, co-invests with the private sector to increase the flow of funds into renewable energy, energy efficiency and low-emissions technologies.

Australian Government Policies are regularly reviewed to ensure they remain effective. There are several agencies that are tasked with regulating, monitoring and reporting on the implementation and outcomes of Australian climate change policy. This includes the Climate Change Authority (CCA), the CER, the Australian National Audit Office (ANAO) and the Department of the Environment and Energy.

The ANAO is an independent office established under the *Auditor-General Act 1997*. Its purpose is to drive accountability and transparency in the Australian Government sector. It achieves this through quality evidence-based audit services and independent reporting to Parliament, the Executive and the public, with the aim of improving public sector performance.

The ANAO conducts performance audits of government agencies operating under the *Standard on Assurance Engagements ASAE 3500 Performance Engagements* issued by the Australian Auditing and Assurance Standards Board. The ANAO reports are tabled in the Australian Parliament and subject to review by the Joint Committee of Public Accounts and Audit.

In 2017, the ANAO undertook a performance audit of the National Inventory to assess the effectiveness of arrangements for the preparation and reporting of Australia's greenhouse gas emissions estimates in the *National Inventory Report 2014*. In 2018, the ANAO undertook a performance audit of the Renewable Energy Target to assess the effectiveness of the CER's administration of the Renewable Energy Target scheme (see section 7.2 for further details).

The CCA is an independent statutory agency established by the *Climate Change Authority Act 2011*. The Authority provides expert advice to the Government on policy to reduce emissions and is required by legislation to conduct periodic reviews of the *Carbon Credits (Carbon Farming Initiative) Act 2011*

and associated instruments and policies, including the Emissions Reduction Fund, and the *National Greenhouse and Energy Reporting Act 2007* and associated instruments.

CCA reviews are undertaken on other matters as requested by the Minister responsible for climate change or the Australian Parliament. The CCA also conducts and commissions its own independent research and analysis.

Since the seventh National Communication, the CCA has conducted legislated reviews in relation to:

- the Emissions Reduction Fund
- the National Greenhouse and Energy Reporting legislation

The Department of the Environment and Energy also conducts its own monitoring, evaluation and reporting related to the implementation of and outcomes achieved through climate change policies. For example, the Government committed to reviewing Australia's climate change policies in 2017. The aim of the review was to ensure Australia's emissions reduction policies effective in achieving Australia's international emissions reduction commitments.

Public consultation is integral to Australia's policy-making processes. Advice is sought through the release of discussion papers or draft legislation for public comment or through face-to-face consultation. Regular engagement is facilitated through a dedicated climate change policy outreach and engagement team in the Department of the Environment and Energy.

7.2 Policy reviews

ANAO performance audit: 2016–17

The ANAO undertook a performance audit of the National Inventory from August 2016 to April 2017. The objective of the audit was to assess the effectiveness of arrangements for the preparation and reporting of Australia's greenhouse gas emissions estimates in the *National Inventory Report 2014* (revised) for the year 2014.

Through the course of the audit the ANAO:

- Examined Department records relating to the preparation of the greenhouse gas emissions estimates, including UNFCCC and departmental guides, implementation plans, quality assurance/quality control documents, and general governance documentation.
- Examined ten inventory sectors representing more than 50 per cent of national emissions.
- Examined key IT controls supporting the AGEIS and the Full Carbon Accounting Model (FullCAM), which estimates emissions and removals from the land use, land-use change and forestry (LULUCF) sector and Kyoto Protocol LULUCF activities.
- Interviewed Department staff and sought input from the public and key stakeholders.

The ANAO audit found that the Department has established appropriate processes to prepare, calculate and publish Australia's National Inventory for the year 2014 and that emissions estimates have been calculated using relevant contemporary data. The audit also found that appropriate quality assurance and control procedures are in place for inventory data processing, emissions calculations and reporting. The aggregate impact of data issues identified in the national inventory across the time series 1990–2014 was less than 0.1 per cent per year. All data issues identified by the ANAO audit have been addressed or corrected since the delivery of the audit outcomes in 2017.

Through the audit, the ANAO also made a number of recommendations relating to improving the data accuracy, security and governance arrangements for the preparation, calculation and publication of the National Inventory. Measures to address aspects of these recommendations were implemented through the course of the preparation of the *National Inventory Report 2015*. One such measure was a 'Rounding policy for AGEIS inputs' to promote consistent decision making in inventory compilation.

2017 Review of climate change policies

The Government's 2017 review of its climate change policies demonstrated that its policies were effective in achieving Australia's international emissions reduction commitments. The review showed it had policies that remain appropriately flexible and scalable to meet future commitments.

The review looked at the opportunities and challenges of reducing emissions on a sector by sector basis, taking into consideration the different circumstances and characteristics of each sector. Specifically, the review investigated:

- the impact of policies on jobs, investment, trade competitiveness, households and regional Australia
- the integration of climate change and energy policy, including the impact of state-based policies on achieving an effective national approach
- the role and operation of the Emissions Reduction Fund and the Safeguard Mechanism
- complementary policies, including the NEPP
- the role of research and development and innovation
- the potential role of credible international units in meeting Australia's emissions targets
- a potential long-term emissions reduction goal post-2030.

The review found that Australia is well positioned to meet its emission reduction targets. The required abatement task has progressively reduced and Australia has a comprehensive set of policies covering every sector of the economy. Australia maintains that a sector by sector approach is the best way to meet emissions reduction target.

The review also found that Australia is playing a large role in the global effort to address climate change. Australia is helping other countries reduce their emissions through bilateral and multilateral initiatives, such as the Asia-Pacific Rainforest Partnership, the International Coral Reef Initiative and the International Partnership for Blue Carbon. The review highlighted Australia is continuing to make globally recognised contributions to climate science and clean energy research and development.

The review provided six recommendations that, in conjunction with current climate change policies, will support Australia's approach to meet emissions reductions targets as well as jobs and strong economic growth. Recommendations provided through the review included:

- domestic policy '*Review and refine cycles*' with the five yearly review process under the Paris Agreement
- simplifying the Safeguard Mechanism
- transitioning to a low-carbon transport sector
- developing a long-term climate change strategy.

The Government agreed to all of the recommendations provided through the review and has progressed actions to address several of them.

The Government has committed to introducing domestic policy *'Review and refine cycles'* with the five yearly review process under the Paris Agreement (while noting that from time to time policies will need to be adjusted outside this cycle as circumstances arise). This approach will provide for integrated consideration of domestic policy and international targets, and provide guidance for industry about future policy review processes.

In 2019, the Government made changes to the Safeguard Mechanism to make it fairer and simpler. The Government has committed to a further review of the Safeguard Mechanism in 2020. The review will consider any updates to rules and regulations in the context of progress towards the 2030 target. In 2019, the Government also announced the development of a National Electric Vehicle Strategy as a part of the Climate Solutions Package.

Australia has also committed to developing a whole of economy long-term emissions reduction strategy by 2020. This strategy will explore the emissions reduction opportunities and implications across all major sectors of the economy. It will also explore the transition to a lower-emissions Australian economy in the context of the global goal established under the Paris Agreement and predicated on the imperative of strong economic growth and an internationally competitive economy. The Government will consult widely with businesses, the community and commonwealth, state and territory agencies on the development of the strategy. The Government will consult widely with governments, businesses and the community in developing this strategy.

Climate Change Authority review of the Emissions Reduction Fund

The CCA is required under the *Carbon Credits (Carbon Farming Initiative) Act 2011* to review the operation of the Emissions Reduction Fund (ERF) every three years. As the Act was amended in 2014, 2017 was the first review of the Fund since its inception. The CCA provided the final report of the review to the Minister on 11 December 2017.

Through the review, the CCA found that the ERF is performing well and is creating incentives for new domestic emissions reductions at low cost that will contribute to Australia's targets under the Paris Agreement. The review also found that an effective architecture has been put in place to credit abatement across the economy, which enables Government purchasing and ensures compliance with the scheme.

The CCA acknowledged that the ERF was designed so that it could be refined over time as knowledge and experience related to the scheme increases. With this in mind, the CCA provided 26 detailed technical recommendations to improve the operation of the ERF. These recommendations aim to enhance environmental integrity and increase abatement, secure permanence of carbon stored in vegetation and soil and strengthen investment and contract delivery. Recommendations also aim to improve administration and compliance and expand access and opportunity for new participants. The recommendations are addressed to both the Department of the Environment and Energy and key stakeholders such as the Clean Energy Regulator, the Emissions Reduction Assurance Committee, industry bodies and local government associations. Further information on the CCAs recommendations can be found in the CCA review report available at http://climatechangeauthority.gov.au/review-emissions-reduction-fund.

The Government has actioned, or is in the process of actioning, most recommendations made in the review. The Australian Government accepted 14 recommendations, accepted-in-principle four recommendations, accepted one recommendation in part and noted five recommendations.

In response to the CCA's recommendations, the Department of the Environment and Energy has taken action to improve transparency within the ERF. This includes separating Senior Executive accountabilities for method development and the Emissions Reduction Assurance Committee's secretariat to address a perceived conflict of interest. The Department has also committed to improving transparency for ERF projects.

The Department of the Environment and Energy, together with the Clean Energy Regulator, has committed to continue to monitor and address risks to the ERF on an ongoing basis. This includes continuing to examine the operation and adequacy of scheme requirements as the ERF matures and progressing the requirement that designated agents, including authorised representatives and authorised bidders, will be required to pass the '*Fit and proper person*' test.

The Emissions Reduction Assurance Committee has already undertaken or is currently undertaking much of the work identified in the relevant review recommendations. This includes endorsing a new soil carbon method, including examining the interaction of natural variability and management action on soil carbon levels. It is also undertaking a review of the Human-Induced Regeneration and Native Forest from Managed Regrowth methods and completing a crediting period review of the Landfill Gas method. The Committee has committed to undertake a periodic review of the Landfill Gas method into the future.

The CER has also progressed several recommendations provided by the CCA to improve the transparency of the ERF scheme. This includes agreeing to create a search function on their website which will assist potential land buyers or other eligible interest holders to determine if individual properties are subject to ERF permanence obligations. The CER will also develop guidance on permanence obligations for conveyancers, law societies and future scheme participants and will explore other appropriate mechanisms to enhance transparency and effectiveness of permanence obligations.

The Government is also exploring opportunities to reduce barriers to participation in the ERF, including addressing any potential barriers to participation from Safeguard facilities and addressing disincentives for facilities to reduce their indirect emissions. The Government is pursuing an amendment to the *National Greenhouse and Energy Reporting Act 2007* to facilitate this outcome.

The next CCA review of the ERF is due to take place in 2020.

CCA review of National Greenhouse and Energy Reporting legislation

In 2007, the Australian Government introduced a single, national framework for corporations to report on greenhouse gas emissions, energy consumption and energy production data. This framework operates under the *National Greenhouse and Energy Reporting Act 2007* (the NGER Act). Further information on the NGERS can be found in Chapter 2.

Under the NGER Act, the CCA is required to undertake periodic reviews of the operation of the National Greenhouse and Energy Reporting legislation. The inaugural review was concluded in December 2018 (the full review is available at: http://climatechangeauthority.gov.au/call-public-input-review-national-greenhouse-and-energy-reporting-legislation).

Through the review, the CCA concluded that the legislation is operating well, is meeting its objectives and is generally fit for purpose. The CCA noted the reporting scheme has wide support from industry,

governments and others who use the information reported. It also noted the Safeguard Mechanism is working as intended as all facilities covered by it have kept their net emissions at or below their emissions limits.

The review report contains 20 recommendations. The Australian Government accepted 13 recommendations and noted seven recommendations. The accepted recommendations are being progressed by the Government in consultation with relevant stakeholders.

ANAO Renewable Energy Target: 2018

The ANAO undertook a performance audit of the Renewable Energy Target in 2018. The objective of the ANAO audit was to assess the effectiveness of the CERs administration of the Renewable Energy Target scheme. The ANAO audit found that the CER has effectively administered the Renewable Energy Target scheme, except for the enforcement activities of its investigations unit. The audit also found:

- The CER has established effective arrangements to register renewable energy systems and validate renewable energy certificates. Scheme participants received appropriate assistance to register renewable power stations and create certificates. Large-scale power stations are accredited and registered after effective assessments, in line with scheme requirements. Certificates created by scheme participants are appropriately validated by the regulator.
- The CER is effectively monitoring the surrender of renewable energy certificates by liable entities. The regulator correctly calculated and imposed shortfall charges on those liable entities that did not meet their surrender liabilities.
- The CER has mostly effective compliance monitoring and enforcement arrangements for the scheme. Scheme intelligence and data analysis has helped in the targeting of compliance monitoring and enforcement activities. Scheme compliance risks are being addressed through compliance monitoring activities. While administrative actions have been appropriately handled by the SRES compliance team, governance of the regulator's investigations unit has been insufficient to ensure that its investigation procedures and processes are satisfactory, consistently applied and result in timely investigations.
- The CER has established appropriate governance arrangements to manage the risks and operation of the scheme. Effective oversight arrangements have been established for the scheme, with scheme implementation documented in multiple business and support plans. Annual certificate surrender targets have been calculated consistent with legislative requirements. The regulator's external reporting for the scheme is supported by an established performance management framework.

Through the audit, the ANAO made four recommendations which were agreed to by CER. The recommendations related to the CER are as follows:

- Assess the extent to which its Renewable Energy Target scheme data shows any residual systemic electrical safety risks for small generation units installed under the scheme and inform those stakeholders in the best position to effect further treatments.
- Establish governance mechanisms to manage its investigations function to ensure mandated investigation requirements are contained in standard operating procedures; that the procedures are consistently applied and that investigations are undertaken in a timely manner.
- Develop an overarching map to document and link the various elements of the operation and governance of the Renewable Energy Target scheme.

- Refine the design of its performance measurement and reporting framework to ensure it is addressing the requirements of the Commonwealth performance framework to demonstrate progress against its purpose using relevant, reliable and complete performance criteria.

The CER has progressed action against the recommendations provided by the ANAO. This includes maturing the CER performance measurement and reporting framework which is reflected in CER's 2019–2023 Corporate Plan. The CER has also established new governance mechanisms to manage the investigations function and to coordinate the overall compliance and enforcement focus of the agency. The CER will also develop a report that analyses the Renewable Energy Target scheme data to determine if there is any residual systemic electrical safety risks for small generation units installed under the scheme and will inform those stakeholders in the best position to effect further treatments.

Climate Change Authority's review of the National Wind Farm Commissioner

In 2015, the Australian Government appointed the National Wind Farm Commissioner in response to community concerns about wind farms. Under the Terms of Reference for the Commissioner, this included a commitment that the Government would review the role of the Commissioner prior to the conclusion of the three year period.

In line with the Terms of Reference, the former Minister for the Environment and Energy, the Hon Josh Frydenberg MP, asked the Climate Change Authority (the Authority) to conduct the review. The Authority delivered its final review in May 2018 (the full review is available at: http://climatechangeauthority.gov.au/review-national-wind-farm-commissioner).

Through the review the Authority found that overall the role of the Commissioner had exceeded expectations, and had a positive impact when dealing with community concerns about wind farms.

The review report contained 11 recommendations and the Australian Government accepted all of them. In line with the review, the Commissioner was reappointed for another three year period in November 2018 with the role expanded to also resolve complaints about large scale solar and storage, including batteries. The revised Terms of Reference for the Commissioner are available at www.nwfc.gov.au.

Appendix 1 – UNFCCC CTF Tables

To the extent of any inconsistency between the numbers and information provided in the Common Tabular Format Tables in this document and those in the Biennial Report Common Tabular Format Application, the Australian Government considers that this document is authoritative.

CTF Table 1.1(a): Greenhouse Gas Emissions (kt CO_2-e) Trends: Summary

GREENHOUSE GAS EMISSIONS	CO_2 emissions without net CO_2 from LULUCF	CO_2 emissions with net CO_2 from LULUCF	CH_4 emissions without CH_4 from LULUCF	CH_4 emissions with CH_4 from LULUCF	N_2O emissions without N_2O from LULUCF	N_2O emissions with N_2O from LULUCF	HFCs
kt CO_2 eq							
Base year[a]	278424.38	443947.25	120080.86	134838.02	15557.84	19866.25	1424.68
1990	278424.38	443947.25	120080.86	134838.02	15557.84	19866.25	1424.68
1991	279872.36	423474.10	120042.19	133990.88	15192.14	19230.16	1424.68
1992	284912.12	364898.76	119577.73	132159.12	15018.04	18711.26	1333.18
1993	289234.86	351307.44	116087.86	128141.83	15487.25	19050.14	1829.87
1994	294014.61	347559.57	112851.97	124520.20	15951.01	19481.56	1027.34
1995	305409.80	337702.29	111415.61	123235.05	15236.46	18805.81	1004.03
1996	312361.21	343382.08	111548.45	123776.31	16482.82	20324.66	414.17
1997	320794.70	350628.09	114369.35	126629.78	17265.10	21054.41	705.23
1998	334684.11	352629.32	113317.62	125715.50	17505.16	21302.95	998.29
1999	344063.34	369514.40	109246.80	122176.73	17992.40	22141.74	1374.54
2000	350194.58	382861.90	112760.68	126927.57	18949.91	23250.79	1613.95
2001	357668.74	412126.15	111201.79	124863.41	19263.36	23494.62	2307.11
2002	362209.09	409804.33	109437.20	123293.27	19793.73	24062.67	2925.90
2003	369725.55	426032.27	104285.45	118003.46	18615.96	22966.15	3578.90
2004	383204.65	432365.29	106239.98	119103.08	20275.00	24282.00	4267.14
2005	386514.92	458090.79	107932.63	120923.26	20362.79	24582.79	5002.76
2006	392681.87	459365.96	107404.08	121449.08	20311.50	24633.09	5166.71
2007	400415.41	475378.84	107117.62	121590.99	18781.39	23234.11	6066.19
2008	405048.54	465576.43	105458.66	119217.39	19057.99	23421.64	6858.96
2009	408344.93	460007.98	104534.88	118086.83	19418.93	23910.74	8109.07
2010	406425.94	437062.42	102500.68	115794.10	19311.91	24062.20	8610.66
2011	404263.70	415589.33	104377.89	117493.42	20048.27	24986.48	9148.67
2012	406986.98	408400.79	103741.19	115834.58	20385.22	24988.17	9060.09
2013	398051.59	388937.91	102966.82	115108.61	19213.96	23489.67	9867.32
2014	393288.53	384721.92	100888.75	113274.23	19647.37	23927.75	10784.75
2015	402537.56	383467.31	101348.20	113091.10	19144.00	22933.51	11801.65
2016	413157.39	381423.56	102048.50	113608.92	19172.50	23004.68	11982.60
2017	417041.28	381754.42	103602.32	115532.66	20851.18	24776.59	12252.94
Change from base to latest reported year	49.79	−14.01	−13.72	−14.32	34.02	24.72	760.05
(%)							

CTF Table 1.1(a)

GREENHOUSE GAS EMISSIONS	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt CO_2 eq																													(%)
PFCs	4607.01	4607.01	4610.74	4603.28	3315.53	2164.43	1530.84	1410.40	1228.15	1660.52	1139.06	1287.06	1801.88	1727.62	1683.98	1713.85	1791.70	687.06	582.68	444.52	358.55	283.32	301.30	294.88	192.00	192.54	171.32	224.92	202.63	–95.60
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
SF_6	220.56	220.56	239.34	258.11	276.87	295.61	316.21	289.10	266.77	240.21	211.29	212.43	218.80	225.10	229.11	230.66	196.22	186.07	175.13	163.32	146.99	142.74	140.79	147.50	141.83	155.17	170.94	185.85	176.22	–20.10
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total (without LULUCF)	420315.32	420315.32	421381.46	425702.48	426232.23	426304.97	434912.95	442506.14	454629.30	468405.89	474027.43	485018.62	492461.68	496318.64	498118.96	515931.29	521801.01	526437.29	533138.42	537031.99	540913.37	537275.25	538280.61	540615.86	530433.52	524957.10	535173.67	546771.76	554126.56	31.84
Total (with LULUCF)	604903.78	604903.78	582969.91	521963.72	503921.68	495048.71	482594.24	489596.70	500512.44	502546.79	516557.76	536153.69	564811.96	562038.90	572493.88	581962.02	610587.52	611487.96	627027.93	615682.26	610620.18	585955.43	567659.99	558726.01	537737.35	533056.36	531635.84	530430.53	534695.45	–11.61
Total (without LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Total (with LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00

CTF Table 1.1(b): Greenhouse Gas Source and Sink Categories (kt CO_2-e)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt CO_2 eq																													(%)
1. Energy	294010.18	294010.18	296580.24	303154.41	305979.01	306653.03	318838.24	326212.78	337253.43	350642.67	355556.88	364291.34	371477.35	374600.50	380070.16	393503.49	399634.60	405966.94	413805.02	419448.50	424728.03	420136.76	416731.04	422237.87	414450.48	408686.07	420302.60	432094.82	435648.63	48.17
2. Industrial processes and product use	26031.43	26031.43	25281.05	25901.14	25612.92	25548.78	25201.91	24939.14	25095.53	26373.54	26842.56	26683.68	27870.15	28563.50	31167.48	32622.56	31875.60	31951.48	34210.65	34424.16	32781.98	35645.61	36250.99	33406.34	31503.37	31158.89	32837.43	32995.17	33686.46	29.41
3. Agriculture	80247.70	80247.70	79515.33	76892.88	75046.83	75201.50	72018.34	74118.65	75312.61	75244.09	75393.55	78382.35	77241.40	77167.42	71972.76	75287.44	75903.82	74343.91	70608.59	68169.66	68502.83	66279.92	70754.36	71987.57	72114.95	72622.02	70084.51	69273.94	73003.95	−9.03
4. Land Use, Land-Use Change and Forestry[b]	184588.46	184588.46	161588.45	96261.24	77689.45	68743.74	47681.28	47090.56	45883.14	34140.89	42530.33	51135.08	72350.28	65720.25	74374.92	66030.73	88786.51	85050.67	93889.51	78650.26	69706.80	48680.18	29379.38	18110.14	7303.83	8099.26	−3537.84	−16341.23	−19431.11	−110.53
5. Waste	20026.01	20026.01	20004.84	19754.05	19593.47	18901.65	18854.46	17235.56	16967.73	16145.59	16234.44	15661.25	15872.79	15987.23	14908.56	14517.79	14386.99	14174.95	14514.16	14989.67	14900.53	15212.96	14544.22	12984.08	12364.73	12490.12	11949.14	12407.84	11787.52	−41.14
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total (including LULUCF)	604903.78	604903.78	582969.91	521963.72	503921.68	495048.71	482594.24	489596.70	500512.44	502546.79	516557.76	536153.69	564811.96	562038.90	572493.88	581962.02	610587.52	611487.96	627027.93	615682.26	610620.18	585955.43	567659.99	558726.01	537737.35	533056.36	531635.84	530430.53	534695.45	−11.61

CTF Table 1.1(b)

CTF Table 1.2: Emissions Trends: CO_2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
1. Energy	259089.06	259089.06	261077.89	265636.31	269692.69	272493.52	283546.80	290186.95	298419.56	311658.25	320154.84	326738.21	334467.42	338882.77	344699.05	357307.12	362401.84	367646.61	374036.39	379435.63	385300.81	380849.19	378049.09	383510.07	376234.99	372218.41	380865.82	391363.61	394703.22	52.34
A. Fuel combustion (sectoral approach)	251676.18	251676.18	253930.96	258171.11	262400.84	265436.49	276243.42	283143.92	291385.02	304390.15	312666.17	318461.18	325972.15	330511.87	337196.41	350140.12	355153.15	360281.11	366203.09	371623.27	376938.67	372262.48	369816.89	374869.42	367052.59	362549.38	369692.27	378134.80	378658.60	50.45
1. Energy industries	142550.69	142550.69	145798.89	149113.82	150856.91	151678.66	157480.76	162065.78	168676.29	181227.97	188414.68	191300.61	198481.43	200598.68	203856.49	212923.58	215219.58	219705.34	222727.89	224490.41	230122.17	224253.21	219120.85	220112.09	209278.55	203088.36	210017.58	218,283.00	216,468.24	51.85
2. Manufacturing industries and construction	35866.54	35866.54	35411.64	34991.93	35542.95	36314.33	37242.62	37257.61	37342.36	37440.66	37694.58	38507.77	38027.96	38705.24	39194.99	40063.57	41127.21	40191.29	40457.91	42551.08	41807.36	40998.17	40519.46	43568.59	45864.25	45740.89	43358.03	41,279.60	40,814.56	13.80
3. Transport	59821.60	59821.60	59163.85	60087.58	61562.18	62998.06	66231.55	68032.40	69277.18	69393.71	70156.60	71712.11	71659.44	73057.25	75417.28	78428.11	79580.57	80926.38	83322.10	84461.16	84905.52	86460.49	89146.84	89744.06	90035.72	91233.09	93259.15	94,417.55	96,840.98	61.88
4. Other sectors	13018.36	13018.36	13114.24	13484.55	13939.09	13886.88	14598.53	15013.66	15275.71	15625.54	15773.55	16311.59	17170.17	17565.27	18172.02	18147.23	18608.09	18809.04	18693.93	19085.45	19287.80	19669.44	20139.36	20580.50	20970.55	21469.98	22120.20	23,040.65	23,618.77	81.43

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
5. Other	419.00	419.00	442.34	493.23	499.71	558.57	689.95	774.48	813.49	702.26	626.76	629.11	633.15	585.44	555.64	577.64	617.70	649.05	1001.26	1035.17	815.82	881.18	890.39	864.17	903.52	1017.06	937.32	1,114.00	916.05	
B. Fugitive emissions from fuels	7412.88	7412.88	7146.93	7465.20	7291.85	7057.03	7303.38	7043.03	7034.53	7268.10	7488.67	8277.03	8495.27	8370.89	7502.64	7167.00	7248.69	7365.51	7833.30	7812.35	8362.14	8586.71	8232.20	8640.66	9182.40	9669.02	11173.55	13228.81	16044.62	116.44
1. Solid fuels	1183.88	1183.88	1171.77	1300.99	1195.27	1119.44	1111.53	1222.65	1333.08	1320.77	1127.85	1150.51	1218.13	1239.57	1099.09	1058.06	1297.98	1214.99	1287.16	1162.36	1308.41	1292.10	1545.96	1580.22	1887.70	1918.10	1909.73	2,063.87	2,143.62	81.07
2. Oil and natural gas and other emissions from energy production	6229.00	6229.00	5975.16	6164.20	6096.58	5937.59	6191.86	5820.38	5701.45	5947.33	6360.82	7126.52	7277.14	7131.32	6403.54	6108.94	5950.71	6150.52	6546.14	6649.99	7053.73	7294.61	6686.24	7060.44	7294.70	7750.92	9263.82	11,164.94	13,901.01	123.17
C. CO_2 transport and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
2. Industrial processes	18679.94	18679.94	18086.07	18512.38	18701.37	20578.41	20864.03	21170.59	21193.49	21669.05	22366.81	21727.58	21354.88	21367.96	23072.46	23834.19	22121.19	23176.86	24534.19	23753.03	21071.03	23357.91	23984.24	21401.88	19748.10	18548.43	19064.71	19099.91	19445.57	4.10
A. Mineral industry	5489.59	5489.59	5152.40	4966.20	5195.81	5996.34	5826.40	5901.72	5977.00	6357.07	6439.33	6231.93	6238.69	6291.22	6429.03	6389.42	6478.76	6669.00	6985.47	6898.40	6408.20	6303.98	6438.83	6412.81	6106.25	5785.48	5639.26	5,686.22	5,600.18	2.01
B. Chemical industry	1054.69	1054.69	1061.08	1114.75	1181.62	1213.30	1379.75	1397.95	1373.47	1550.46	1544.67	1696.09	1957.79	1989.85	2347.20	2525.76	2681.46	3395.44	3968.88	3411.06	3138.47	3538.29	3488.64	3184.17	3091.60	2771.17	3170.93	3,063.00	3,073.58	191.42

CTF Table 1.2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
C. Metal industry	11773.15	11773.15	11528.49	12086.22	11967.88	13004.64	13250.23	13453.22	13420.49	13341.13	13968.43	13370.33	12717.08	12637.67	13836.58	14419.75	12539.62	12708.18	13204.29	13045.38	11125.92	13036.79	13563.09	11398.78	10125.11	9608.86	9863.70	9,904.96	10,374.47	−11.88
D. Non-energy products from fuels and solvent use	279.93	279.93	259.04	257.65	266.01	271.58	268.79	278.54	279.93	279.93	271.58	284.11	293.86	299.43	307.79	334.25	253.89	243.75	227.25	234.82	237.03	247.40	232.10	188.11	184.77	181.23	175.09	172.90	184.05	-34.25
E. Electronic industry																														
F. Product uses as ODS substitutes																														
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
H. Other	82.57	82.57	85.07	87.56	90.06	92.55	138.85	139.16	142.59	140.46	142.79	145.12	147.46	149.79	151.86	165.01	167.47	160.49	148.29	163.38	161.41	231.45	261.58	218.01	240.37	201.70	215.73	272.83	213.30	158.32
3. Agriculture	582.01	582.01	634.90	689.81	767.03	868.78	919.40	945.55	1153.69	1328.72	1512.90	1701.12	1818.64	1930.41	1925.92	2035.07	1963.45	1829.69	1815.79	1830.38	1943.18	2189.14	2200.55	2045.07	2038.11	2490.91	2576.56	2663.25	2861.74	391.70
A. Enteric fermentation																														
B. Manure management																														

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
C. Rice cultivation																														
D. Agricultural soils																														
E. Prescribed burning of savannas																														
F. Field burning of agricultural residues																														
G. Liming	215.35	215.35	260.26	316.77	382.83	487.77	439.54	385.99	485.72	585.83	720.58	738.22	761.69	1021.29	1050.19	1079.51	1076.18	1072.84	1069.51	1065.53	1159.49	1252.83	1088.30	924.62	760.32	1138.74	1224.39	1,153.39	1,318.39	512.22
H. Urea application	366.67	366.67	374.64	373.04	384.20	381.01	479.86	559.57	667.97	742.90	792.32	962.90	1056.96	909.12	875.73	955.56	887.27	756.85	746.28	764.85	783.69	936.31	1112.25	1120.46	1277.80	1352.17	1352.17	1,509.86	1,543.35	320.91
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00

CTF Table 1.2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
4. Land Use, Land-Use Change and Forestry	165522.88	165522.88	143601.74	79986.63	62072.58	53544.96	32292.49	31020.87	29833.40	17945.22	25451.06	32667.32	54457.40	47595.24	56306.72	49160.64	71575.87	66684.08	74963.43	60527.89	51663.05	30636.48	11325.64	1413.80	−9113.68	−8566.61	−19070.25	−31733.83	−35286.86	−121.32
A. Forest land	−21998.67	−21998.67	−23644.62	−26101.99	−28261.58	−24750.63	−25912.82	−28911.93	−38812.00	−36156.63	−40003.40	−32698.62	−26309.19	−30241.92	−22569.64	−25618.78	−32795.55	−33548.56	−28296.91	−24901.58	−27240.30	−41849.09	−46330.28	−57100.01	−60537.04	−61864.38	−57471.34	−71,058.90	−68,330.78	210.61
B. Cropland	36399.84	36399.84	31399.01	17011.88	14489.26	12731.82	4004.15	4701.53	5009.59	−2026.28	−2008.37	−3018.33	−1044.65	−1858.00	−457.43	132.97	5117.65	3316.47	5336.01	5972.46	8408.87	2788.82	3265.96	3442.33	3956.50	5341.58	975.37	−793.90	−1,506.17	−104.14
C. Grassland	154680.06	154680.06	138574.71	91661.62	79496.92	70191.21	59611.85	59556.42	67554.64	60954.57	71370.10	73816.55	86638.32	84908.58	85085.56	80889.81	104993.67	101490.41	102339.21	83932.67	74186.17	72717.21	57423.97	58522.65	50649.56	51050.24	41219.13	43,838.75	38,579.69	−75.06
D. Wetlands	867.46	867.46	1259.75	1711.42	1150.90	358.32	380.16	500.21	621.22	607.01	601.61	572.59	391.38	376.07	249.53	114.05	135.83	352.99	336.68	455.84	366.64	610.21	958.73	18.96	39.52	42.36	71.59	−10.97	42.09	−95.15
E. Settlements	2991.12	2991.12	2536.31	2415.10	2012.08	2036.19	1740.80	1558.31	1644.21	1556.04	1575.56	1625.56	1290.30	1214.17	1368.15	1540.77	1820.52	1906.28	1576.95	1539.83	985.42	1074.04	988.72	846.86	856.02	867.90	627.36	885.65	577.72	−80.69
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	G. Harvested wood products	H. Other	5. Waste	A. Solid waste disposal	B. Biological treatment of solid waste	C. Incineration and open burning of waste	D. Waste water treatment and discharge	E. Other
kt								
Base year[a]	–7416.93	NA	73.36	NO		73.36		NO
1990	–7416.93	NA	73.36	NO		73.36		NO
1991	–6523.42	NA	73.50	NO		73.50		NO
1992	–6711.39	NA	73.63	NO		73.63		NO
1993	–6815.00	NA	73.76	NO		73.76		NO
1994	–7021.96	NA	73.89	NO		73.89		NO
1995	–7531.64	NA	79.58	NO		79.58		NO
1996	–6383.67	NA	58.12	NO		58.12		NO
1997	–6184.26	NA	27.97	NO		27.97		NO
1998	–6989.49	NA	28.08	NO		28.08		NO
1999	–6084.44	NA	28.78	NO		28.78		NO
2000	–7630.43	NA	27.66	NO		27.66		NO
2001	–6508.76	NA	27.81	NO		27.81		NO
2002	–6803.65	NA	27.96	NO		27.96		NO
2003	–7369.45	NA	28.11	NO		28.11		NO
2004	–7898.18	NA	28.26	NO		28.26		NO
2005	–7696.24	NA	28.43	NO		28.43		NO
2006	–6833.52	NA	28.70	NO		28.70		NO
2007	–6328.51	NA	29.05	NO		29.05		NO
2008	–6471.33	NA	29.49	NO		29.49		NO
2009	–5043.75	NA	29.91	NO		29.91		NO
2010	–4704.71	NA	29.71	NO		29.71		NO
2011	–4981.48	NA	29.81	NO		29.81		NO
2012	–4316.98	NA	29.96	NO		29.96		NO
2013	–4078.22	NA	30.39	NO		30.39		NO
2014	–4004.30	NA	30.79	NO		30.79		NO
2015	–4492.36	NA	30.48	NO		30.48		NO
2016	–4,594.46	NA	30.63	NO		30.63		NO
2017	–4,649.40	NA	30.75	NO		30.75		NO
Change from base to latest reported year (%)	–37.31	0.00	–58.09	0.00		–58.09		0.00

CTF Table 1.2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Memo items																														
International bunkers	6460.40	6460.40	6436.17	6645.57	7050.38	7431.58	8613.75	9111.05	9141.94	9532.99	9804.70	10192.67	10489.67	9620.18	8770.82	9992.89	10948.22	11554.70	11925.51	12209.31	12188.05	12442.13	11958.10	12918.58	12970.43	14128.32	13521.78	14136.11	15341.49	137.47
Aviation	4382.71	4382.71	4558.80	4837.20	5244.36	5396.78	5908.34	6363.53	6595.99	7293.38	7328.88	7394.30	7861.32	6751.90	5974.78	7173.67	8292.48	8393.76	9357.83	9271.62	9474.02	10347.62	10093.39	10472.02	11026.03	11893.25	11820.86	12,440.93	13,604.16	210.40
Navigation	2077.69	2077.69	1877.37	1808.37	1806.02	2034.79	2705.40	2747.52	2545.95	2239.61	2475.82	2798.37	2628.35	2868.28	2796.04	2819.22	2655.74	3160.94	2567.69	2937.70	2714.02	2094.52	1864.70	2446.56	1944.39	2235.07	1700.92	1,695.17	1,737.33	−16.38
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 emissions from biomass	15142.27	15142.27	15017.92	13705.03	15366.51	16319.27	17109.55	18140.99	19020.64	19328.69	19067.45	19243.87	18429.67	16548.89	18217.18	18497.26	19092.02	19106.10	19274.46	19671.38	14612.76	17090.87	16028.22	16421.21	18080.25	17889.98	19029.36	19,034.30	20,016.95	32.19
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Long-term storage of C in waste disposal sites	45235.23	45235.23	46322.59	47394.21	48450.28	49492.84	50546.99	51661.24	52753.43	53849.62	54995.19	56102.88	57291.26	58435.97	59569.19	60722.40	61949.46	63166.61	64325.12	65465.17	66596.46	67655.89	68624.17	69594.31	70501.56	71386.14	72245.44	73,108.16	73,940.90	63.46

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
Indirect N_2O																														
Indirect CO_2 (3)	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0.00
Total CO_2 equivalent emissions without land use, land-use change and forestry	278424.38	278424.38	279872.36	284912.12	289234.86	294014.61	305409.80	312361.21	320794.70	334684.11	344063.34	350194.58	357668.74	362209.09	369725.55	383204.65	386514.92	392681.87	400415.41	405048.54	408344.93	406425.94	404263.70	406986.98	398051.59	393288.53	402537.56	413157.39	417041.28	49.79
Total CO_2 equivalent emissions with land use, land-use change and forestry	443947.25	443947.25	423474.10	364898.76	351307.44	347559.57	337702.29	343382.08	350628.09	352629.32	369514.40	382861.90	412126.15	409804.33	426032.27	432365.29	458090.79	459365.96	475378.84	465576.43	460007.98	437062.42	415589.33	408400.79	388937.91	384721.92	383467.31	381423.56	381754.42	–14.01
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00

Abbreviation: LULUCF = Land use, land-use change and forestry, NO = Not Occurring, NE = Not Estimated, IE = Included Elsewhere and NA = Not Applicable

a The column 'Base year' should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Includes net CO_2, CH_4 and N_2O from LULUCF.

CTF Table 1.2

CTF Table 1.3: Emissions trends: CH_4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
1. Energy	1318.38	1318.38	1340.25	1418.43	1363.69	1275.17	1315.29	1340.79	1448.05	1447.25	1299.30	1380.74	1353.64	1293.03	1268.62	1297.19	1337.54	1382.56	1439.15	1448.62	1429.48	1426.89	1399.47	1402.42	1382.83	1318.34	1446.01	1498.89	1507.18	14.32
A. Fuel combustion (sectoral approach)	127.21	127.21	129.73	133.18	134.12	131.88	129.18	126.32	123.47	117.40	110.32	105.29	102.59	90.13	88.51	86.42	81.37	79.63	76.84	74.52	80.22	76.87	68.63	71.69	69.45	72.72	74.17	81.34	78.87	–38.00
1. Energy industries	1.68	1.68	1.64	1.68	1.73	1.76	1.88	1.94	1.99	3.77	3.84	6.41	6.73	6.46	6.29	6.59	6.35	6.89	7.09	7.56	16.39	14.97	10.49	14.03	12.21	16.67	19.39	27.37	25.36	1408.75
2. Manufacturing industries and construction	2.06	2.06	2.00	1.88	2.05	2.17	2.23	2.28	2.24	2.28	2.29	2.26	2.10	2.08	2.12	2.19	2.28	2.35	2.40	2.48	1.94	2.27	2.26	2.39	2.57	2.45	2.53	2.46	2.46	19.33
3. Transport	26.35	26.35	26.29	26.99	27.83	28.59	29.67	30.18	30.24	29.31	28.74	27.32	26.01	26.32	25.49	24.93	22.01	21.28	19.91	18.79	18.07	17.71	16.62	16.00	15.41	15.08	15.05	14.71	14.52	–44.90
4. Other sectors	97.10	97.10	99.78	102.61	102.48	99.33	95.36	91.88	88.95	82.00	75.42	69.27	67.74	55.25	54.60	52.70	50.70	49.09	47.39	45.64	43.78	41.89	39.23	39.23	39.24	38.49	37.16	36.76	36.50	–62.41
5. Other	0.03	0.03	0.02	0.03	0.02	0.03	0.04	0.04	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	17.90
B. Fugitive emissions from fuels	1191.17	1191.17	1210.52	1285.25	1229.57	1143.29	1186.11	1214.46	1324.58	1329.85	1188.98	1275.45	1251.05	1202.90	1180.10	1210.77	1256.17	1302.94	1362.31	1374.10	1349.27	1350.02	1330.85	1330.74	1313.38	1245.62	1371.84	1417.55	1428.32	19.91

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
1. Solid fuels	839.66	839.66	852.40	887.68	894.05	820.13	820.31	838.31	933.97	974.36	903.21	975.80	960.79	930.10	910.90	924.61	995.61	1027.62	1119.01	1105.73	1069.33	1032.54	1010.71	1006.72	973.35	929.23	1017.56	1,009.64	946.29	12.70
2. Oil and natural gas and other emissions from energy production	351.51	351.51	358.12	397.57	335.52	323.16	365.80	376.15	390.60	355.49	285.77	299.65	290.26	272.80	269.21	286.16	260.56	275.32	243.31	268.37	279.94	317.49	320.14	324.02	340.02	316.38	354.28	407.91	482.02	37.13
C. CO_2 transport and storage																														
2. Industrial processes	3.27	3.27	3.01	3.29	3.33	3.72	3.94	4.02	3.94	4.11	3.84	3.47	3.24	3.22	3.46	3.45	3.27	3.55	3.57	3.57	3.09	3.69	3.90	3.01	2.74	2.60	2.75	2.82	2.94	-10.00
A. Mineral industry																														
B. Chemical industry	0.44	0.44	0.40	0.41	0.32	0.40	0.52	0.59	0.57	0.51	0.48	0.58	0.49	0.50	0.58	0.55	0.55	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	32.02
C. Metal industry	2.83	2.83	2.60	2.88	3.01	3.32	3.42	3.42	3.37	3.60	3.36	2.89	2.75	2.71	2.88	2.90	2.72	2.98	3.00	3.00	2.51	3.12	3.33	2.44	2.16	2.02	2.17	2.25	2.36	–16.50
D. Non-energy products from fuels and solvent use	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0.00
E. Electronic industry																														

CTF Table 1.3

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
F. Product uses as ODS substitutes																														
G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
3. Agriculture	2695.97	2695.97	2674.04	2587.38	2509.25	2495.66	2400.06	2444.04	2459.88	2451.75	2433.92	2516.59	2473.42	2459.23	2320.90	2386.50	2419.60	2362.09	2280.89	2187.17	2172.94	2080.86	2210.50	2247.20	2260.50	2239.14	2153.28	2111.91	2190.61	–18.75
A. Enteric fermentation	2585.02	2585.02	2568.98	2477.28	2395.55	2374.72	2289.34	2327.58	2336.81	2327.78	2309.74	2395.83	2340.91	2325.61	2214.08	2271.53	2294.45	2230.75	2170.75	2086.20	2070.45	1973.47	2090.70	2124.19	2139.40	2118.19	2031.91	1,999.08	2,061.74	–20.24
B. Manure management	83.39	83.39	80.74	82.29	83.87	87.95	84.35	82.73	84.24	90.13	89.07	89.73	95.26	100.22	94.04	92.36	109.18	106.28	102.39	94.35	93.67	98.04	99.68	99.16	96.53	101.93	103.67	101.45	105.06	25.98
C. Rice cultivation	15.88	15.88	12.81	17.17	16.98	18.31	17.85	20.70	23.00	19.58	19.72	17.37	23.45	19.17	6.08	8.85	6.86	13.53	2.64	0.27	0.95	2.51	10.05	13.67	15.07	10.17	9.24	3.68	11.41	–28.15
D. Agricultural soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.00
E. Prescribed burning of savannas	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
F. Field burning of agricultural residues	11.68	11.68	11.52	10.63	12.85	14.68	8.52	13.02	15.82	14.26	15.39	13.65	13.80	14.22	6.70	13.76	9.10	11.53	5.12	6.35	7.87	6.85	10.07	10.17	9.51	8.85	8.46	7.70	12.40	6.19
G. Liming																														
H. Urea application																														
I. Other carbon-containing fertilisers																														
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
4. Land use, land-use change and forestry	590.29	590.29	557.95	503.26	482.16	466.73	472.78	489.11	490.42	495.92	517.20	566.68	546.46	554.24	548.72	514.52	519.63	561.80	578.93	550.35	542.08	531.74	524.62	483.74	485.67	495.42	469.72	462.42	477.21	−19.16
A. Forest land	181.50	181.50	180.51	194.20	198.15	180.45	184.64	194.21	175.35	173.19	172.42	198.15	187.61	193.45	201.17	194.16	180.05	192.62	212.24	239.12	238.51	232.49	250.37	225.43	219.44	229.89	238.67	220.95	234.18	29.02
B. Cropland	24.30	24.30	22.49	11.10	7.92	7.50	6.93	6.08	6.76	6.34	5.76	5.95	5.38	5.68	4.87	5.04	5.17	4.89	4.14	3.11	2.55	2.58	2.10	1.78	1.64	2.47	1.70	2.15	1.70	−93.02
C. Grassland	372.52	372.52	344.06	287.93	266.51	270.52	273.24	278.89	297.11	304.83	326.77	348.97	342.21	343.06	330.28	304.31	322.81	351.54	350.30	295.59	288.04	283.92	259.62	244.78	252.56	251.38	218.05	229.17	231.21	−37.93
D. Wetlands	7.80	7.80	7.46	6.94	6.90	5.80	5.69	8.09	9.12	9.53	10.42	11.61	9.92	10.57	10.72	9.01	9.13	10.20	10.13	10.74	11.91	11.55	11.66	11.06	11.32	10.86	10.57	9.39	9.35	19.83

CTF Table 1.3

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
E. Settlements	4.16	4.16	3.43	3.09	2.69	2.46	2.28	1.85	2.09	2.03	1.82	1.99	1.35	1.49	1.68	2.01	2.46	2.56	2.13	1.80	1.07	1.20	0.88	0.68	0.71	0.82	0.73	0.76	0.78	−81.27
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products																														
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
5. Waste	785.62	785.62	784.40	774.01	767.24	739.53	737.35	673.09	662.91	629.59	632.82	609.63	617.77	622.02	578.44	562.45	556.89	547.96	561.09	578.98	575.88	588.58	561.24	497.02	472.60	475.47	451.90	468.32	443.36	−43.56
A. Solid waste disposal	609.60	609.60	608.81	602.53	600.72	577.27	582.00	525.20	520.43	492.67	497.48	489.52	491.23	498.11	460.10	442.48	435.99	424.90	436.07	452.27	449.17	460.08	442.58	391.01	360.03	360.46	340.41	347.77	330.23	−45.83
B. Biological treatment of solid waste	0.35	0.35	0.48	0.62	0.75	0.88	1.01	1.15	1.28	1.41	1.55	1.68	1.81	1.94	2.08	2.21	2.34	2.52	2.66	2.87	3.01	3.40	3.95	4.02	4.09	4.15	4.21	4.32	4.39	1152.17
C. Incineration and open burning of waste	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.06	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	
D. Waste water treatment and discharge	175.58	175.58	175.02	170.77	165.68	161.29	154.24	146.68	141.19	135.51	133.79	118.43	124.73	121.96	116.27	117.77	118.56	120.53	122.36	123.85	123.71	125.10	114.71	101.99	108.48	110.86	107.27	116.23	108.75	−38.06
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total CH_4 emissions without CH_4 from LULUCF	4803.23	4803.23	4801.69	4783.11	4643.51	4514.08	4456.62	4461.94	4574.77	4532.70	4369.87	4510.43	4448.07	4377.49	4171.42	4249.60	4317.31	4296.16	4284.70	4218.35	4181.40	4100.03	4175.12	4149.65	4118.67	4035.55	4053.93	4081.94	4144.09	−13.72
Total CH_4 emissions with CH_4 from LULUCF	5393.52	5393.52	5359.64	5286.36	5125.67	4980.81	4929.40	4951.05	5065.19	5028.62	4887.07	5077.10	4994.54	4931.73	4720.14	4764.12	4836.93	4857.96	4863.64	4768.70	4723.47	4631.76	4699.74	4633.38	4604.34	4530.97	4523.64	4544.36	4621.31	−14.32
Memo items:																														
International bunkers	0.21	0.21	0.19	0.18	0.18	0.21	0.27	0.27	0.26	0.23	0.25	0.28	0.26	0.29	0.28	0.28	0.27	0.32	0.26	0.30	0.28	0.22	0.20	0.25	0.21	0.24	0.19	0.19	0.20	−3.92
Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	325.49
Navigation	0.20	0.20	0.18	0.17	0.17	0.20	0.26	0.26	0.24	0.21	0.24	0.27	0.25	0.28	0.27	0.27	0.25	0.30	0.25	0.28	0.26	0.20	0.18	0.23	0.19	0.21	0.16	0.16	0.17	−16.82
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 emissions from biomass																														
CO_2 captured																														

CTF Table 1.3

CTF Table 1.3

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
Long-term storage of C in waste disposal sites																														
Indirect N_2O																														
Indirect CO_2 (3)																														

Abbreviation: LULUCF = Land use, land-use change and forestry, ODS = Ozone Depleting Substances, NO = Not Occurring, NE = Not Estimated, IE = Included Elsewhere and NA = Not Applicable

a The column 'Base year' should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Includes net CO_2, CH4 and N_2O from LULUCF.

CTF Table 1.4: Emissions trends: N_2O

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
1. Energy	6.58	6.58	6.70	6.90	7.36	7.65	8.08	8.41	8.83	9.41	9.80	10.18	10.63	11.38	12.27	12.64	12.73	12.60	12.72	12.74	12.38	12.13	12.40	12.31	12.23	11.78	11.03	10.94	10.96	66.50
A. Fuel combustion (sectoral approach)	6.45	6.45	6.57	6.78	7.24	7.54	7.97	8.31	8.75	9.32	9.71	10.08	10.53	11.28	12.18	12.56	12.65	12.52	12.63	12.65	12.29	12.03	12.31	12.19	12.11	11.66	10.87	10.72	10.66	65.39
1. Energy industries	1.70	1.70	1.63	1.66	1.73	1.73	1.80	1.84	2.04	2.25	2.23	2.34	2.64	2.99	3.37	3.45	3.64	3.65	3.76	3.74	3.93	3.78	4.19	4.11	4.09	3.90	3.16	3.23	3.23	89.80
2. Manufacturing industries and construction	1.13	1.13	1.11	1.02	1.12	1.17	1.22	1.28	1.32	1.33	1.32	1.30	1.24	1.25	1.26	1.29	1.34	1.33	1.37	1.42	1.10	1.28	1.28	1.38	1.52	1.48	1.49	1.46	1.52	33.78
3. Transport	3.07	3.07	3.28	3.52	3.81	4.05	4.35	4.58	4.78	5.12	5.54	5.81	5.98	6.40	6.88	7.13	6.98	6.86	6.82	6.80	6.59	6.29	6.17	6.01	5.81	5.57	5.48	5.26	5.13	67.11
4. Other sectors	0.53	0.53	0.54	0.56	0.57	0.57	0.58	0.59	0.60	0.60	0.60	0.60	0.64	0.62	0.66	0.66	0.68	0.66	0.65	0.66	0.65	0.65	0.65	0.66	0.67	0.68	0.71	0.74	0.76	43.46
5. Other	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.03	131.78
B. Fugitive emissions from fuels	0.14	0.14	0.12	0.13	0.12	0.11	0.12	0.10	0.09	0.09	0.09	0.10	0.11	0.10	0.08	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.08	0.11	0.12	0.12	0.16	0.22	0.30	119.41
1. Solid fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	296417.43

CTF Table 1.4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
2. Oil and natural gas and other emissions from energy production	0.14	0.14	0.12	0.13	0.12	0.11	0.12	0.10	0.09	0.09	0.09	0.10	0.11	0.10	0.08	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.08	0.11	0.12	0.12	0.16	0.22	0.29	118.24
C. CO_2 transport and storage																														
2. Industrial processes	3.41	3.41	2.84	3.73	4.72	4.66	4.66	5.22	5.38	5.71	5.55	5.89	7.07	7.51	8.44	8.36	9.00	8.88	9.27	10.45	10.13	10.60	8.65	8.14	4.99	4.74	5.24	4.80	5.15	50.91
A. Mineral industry																														
B. Chemical industry	3.34	3.34	2.76	3.65	4.64	4.58	4.58	5.13	5.29	5.63	5.47	5.82	6.99	7.43	8.35	8.26	8.93	8.80	9.19	10.38	10.07	10.53	8.57	8.08	4.93	4.69	5.18	4.75	5.10	52.65
C. Metal industry	0.08	0.08	0.07	0.08	0.08	0.08	0.07	0.09	0.09	0.08	0.09	0.07	0.08	0.08	0.09	0.09	0.07	0.08	0.08	0.08	0.06	0.07	0.08	0.06	0.05	0.05	0.05	0.05	0.06	–25.97
D. Non-energy products from fuels and solvent use	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	0.00
E. Electronic industry																														
F. Product uses as ODS substitutes																														
G. Other product manufacture and use	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
3. Agriculture	41.16	41.16	40.37	38.65	38.75	40.07	37.24	40.51	42.49	42.35	43.73	46.20	45.59	46.16	40.35	45.60	45.14	45.17	39.50	39.13	41.06	40.50	44.60	46.18	45.52	47.49	45.89	46.35	51.60	25.36
A. Enteric fermentation																														
B. Manure management	1.36	1.36	1.40	1.49	1.53	1.65	1.76	1.75	1.72	1.89	2.02	2.34	2.57	2.71	2.72	2.67	3.10	3.24	3.30	2.71	2.72	2.79	2.95	2.93	2.98	3.07	3.44	3.49	3.52	158.83
C. Rice cultivation																														
D. Agricultural soils	39.34	39.34	38.51	36.73	36.71	37.82	35.14	38.23	40.13	39.88	41.07	43.29	42.45	42.87	37.36	42.36	41.66	41.46	36.00	36.16	38.02	37.43	41.24	42.83	42.13	44.05	42.09	42.55	47.55	20.88
E. Prescribed burning of savannas	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00
F. Field burning of agricultural residues	0.47	0.47	0.46	0.44	0.52	0.60	0.34	0.53	0.64	0.58	0.64	0.57	0.57	0.59	0.27	0.57	0.37	0.47	0.20	0.26	0.32	0.28	0.42	0.42	0.41	0.37	0.35	0.32	0.53	13.64
G. Liming																														
H. Urea application																														
I. Other carbon containing fertilizers																														

CTF Table 1.4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
4. Land use, land-use change and forestry	14.46	14.46	13.55	12.39	11.96	11.85	11.98	12.89	12.72	12.74	13.92	14.43	14.20	14.33	14.60	13.45	14.16	14.50	14.94	14.64	15.07	15.94	16.57	15.45	14.35	14.36	12.72	12.86	13.17	−8.89
A. Forest land	3.32	3.32	3.34	3.53	3.56	3.27	3.34	3.56	3.30	3.30	3.47	3.71	3.56	3.62	3.74	3.59	3.40	3.56	3.80	4.26	4.28	4.43	5.03	4.34	4.20	4.46	4.49	4.17	4.46	34.10
B. Cropland	0.54	0.54	0.49	0.31	0.24	0.20	0.22	0.19	0.19	0.20	0.21	0.16	0.16	0.16	0.17	0.14	0.19	0.12	0.17	0.12	0.12	0.14	0.13	0.09	0.12	0.12	0.08	0.13	0.06	−87.90
C. Grassland	9.64	9.64	8.77	7.58	7.14	7.44	7.52	8.09	8.28	8.41	9.24	9.66	9.54	9.59	9.66	8.79	9.42	9.77	9.90	9.16	9.40	9.90	9.63	9.35	8.72	8.47	7.04	7.45	7.55	−21.75
D. Wetlands	0.15	0.15	0.15	0.14	0.13	0.11	0.11	0.16	0.18	0.19	0.21	0.23	0.20	0.21	0.21	0.18	0.18	0.20	0.20	0.21	0.24	0.23	0.23	0.22	0.23	0.22	0.21	0.19	0.19	24.07
E. Settlements	0.09	0.09	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.06	0.06	0.05	0.05	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	−73.64
F. Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
G. Harvested wood products																														
H. Other	0.01	0.01	0.01	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.10	0.10	0.11	0.12	0.12	1349.58

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
5. Waste	1.05	1.05	1.08	1.11	1.14	1.14	1.15	1.18	1.23	1.27	1.29	1.32	1.34	1.37	1.41	1.44	1.46	1.50	1.54	1.63	1.59	1.57	1.62	1.77	1.74	1.92	2.08	2.25	2.26	115.44
A. Solid waste disposal																														
B. Biological treatment of solid waste	0.04	0.04	0.06	0.08	0.10	0.11	0.13	0.15	0.16	0.18	0.20	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.37	0.39	0.44	0.51	0.51	0.52	0.53	0.54	0.55	0.56	1152.17
C. Incineration and open burning of waste	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.02	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	
D. Waste water treatment and discharge	0.96	0.96	0.98	0.99	1.00	0.99	0.98	1.00	1.07	1.09	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.18	1.20	1.26	1.20	1.14	1.12	1.26	1.22	1.39	1.55	1.69	1.70	75.75
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Other (as specified in the summary table in CRF)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Total direct N_2O emissions without N_2O from LULUCF	52.21	52.21	50.98	50.40	51.97	53.53	51.13	55.31	57.94	58.74	60.38	63.59	64.64	66.42	62.47	68.04	68.33	68.16	63.02	63.95	65.16	64.81	67.28	68.41	64.48	65.93	64.24	64.34	69.97	34.02
Total direct N_2O emissions with N_2O from LULUCF	66.67	66.67	64.53	62.79	63.93	65.37	63.11	68.20	70.65	71.49	74.30	78.02	78.84	80.75	77.07	81.48	82.49	82.66	77.97	78.60	80.24	80.75	83.85	83.85	78.82	80.29	76.96	77.20	83.14	24.72

CTF Table 1.4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
Memo items:																														
International bunkers	0.08	0.08	0.08	0.07	0.08	0.08	0.10	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.13	0.12	0.13	0.12	0.11	0.10	0.12	0.11	0.12	0.11	0.11	0.12	45.90
Aviation	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	201.56
Navigation	0.06	0.06	0.05	0.05	0.05	0.06	0.07	0.08	0.07	0.06	0.07	0.08	0.07	0.08	0.08	0.08	0.07	0.09	0.07	0.08	0.07	0.06	0.05	0.07	0.05	0.06	0.05	0.05	0.05	–16.82
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 emissions from biomass																														
CO_2 captured																														
Long-term storage of C in waste disposal sites																														
Indirect N_2O	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	0.00
Indirect CO_2 (3)																														

Abbreviation: LULUCF = Land use, land-use change and forestry, ODS = Ozone Depleting Substances, NO = Not Occurring, NE = Not Estimated, IE = Included Elsewhere and NA = Not Applicable

a The column 'Base year' should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Includes net CO_2, CH_4 and N_2O from LULUCF

CTF Table 1.5: Emissions trends: HFCs, PFCs, SF_6, NF_3

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Emissions of HFCs and PFCs - (kt CO_2 equivalent)	Emissions of HFCs - (kt CO_2 equivalent)	HFC-23	HFC-32	HFC-41	HFC-43-10mee	HFC-125	HFC-134
Base year[a]	kt	6031.70	1424.68	0.10	NO	NO	NO	NO	NO
1990		6031.70	1424.68	0.10	NO	NO	NO	NO	NO
1991		6035.43	1424.68	0.10	NO	NO	NO	NO	NO
1992		5936.47	1333.18	0.09	NO	NO	NO	NO	NO
1993		5145.40	1829.87	0.12	NO	NO	NO	NO	NO
1994		3191.77	1027.34	0.07	0.00	NO	0.00	0.00	0.00
1995		2534.87	1004.03	0.06	0.00	NO	0.00	0.01	0.00
1996		1824.57	414.17	0.00	0.00	NO	0.00	0.05	0.00
1997		1933.38	705.23	0.00	0.00	NO	0.00	0.09	0.00
1998		2658.81	998.29	0.00	0.01	NO	0.00	0.12	0.00
1999		2513.60	1374.54	0.00	0.01	NO	0.00	0.17	0.00
2000		2901.01	1613.95	0.00	0.01	NO	0.00	0.20	0.00
2001		4108.99	2307.11	0.00	0.02	NO	0.00	0.28	0.00
2002		4653.52	2925.90	0.00	0.02	NO	0.00	0.36	0.00
2003		5262.88	3578.90	0.00	0.02	NO	0.00	0.44	0.00
2004		5980.99	4267.14	0.00	0.03	NO	0.00	0.52	0.00
2005		6794.46	5002.76	NO,IE	0.03	NO	NO,IE	0.33	0.00
2006		5853.77	5166.71	NO,IE	0.05	NO	NO,IE	0.35	0.00
2007		6648.86	6066.19	0.04	0.09	NO	NO,IE	0.41	0.00
2008		7303.48	6858.96	0.05	0.11	NO	NO,IE	0.49	0.00
2009		8467.63	8109.07	0.05	0.14	NO	NO,IE	0.59	0.00
2010		8893.97	8610.66	0.05	0.18	NO	NO,IE	0.64	0.00
2011		9449.98	9148.67	0.05	0.22	NO	NO,IE	0.70	0.00
2012		9354.97	9060.09	0.05	0.22	NO	NO,IE	0.67	0.00
2013		10059.32	9867.32	0.06	0.23	NO	NO,IE	0.74	0.00
2014		10977.29	10784.75	0.04	0.39	NO	NO,IE	0.93	0.00
2015		11972.98	11801.65	0.05	0.44	NO	NO,IE	1.02	0.00
2016		12207.52	11982.60	0.04	0.46	NO	NO,IE	1.04	0.00
2017		12455.56	12252.94	0.05	0.47	NO	NO,IE	1.06	0.00
Change from base to latest reported year	(%)	106.50	760.05	–52.33	100.00	0.00	0.00	100.00	100.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
HFC-134a	NO	NO	NO	NO	NO	0.00	0.03	0.14	0.25	0.35	0.48	0.56	0.81	1.02	1.25	1.49	1.37	1.48	1.46	1.58	1.83	1.98	2.22	2.07	2.06	2.45	2.76	2.90	2.97	100.00
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-143a	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.36	0.37	0.38	0.43	0.53	0.55	0.53	0.58	0.67	0.63	0.66	0.64	0.66	100.00
HFC-152	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-152a	NO	NO	NO	NO	NO	NO	NO	NO	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.08	0.09	0.09	0.10	0.11	0.11	100.00
HFC-161	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-227ea	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.03	0.04	0.03	0.02	0.05	0.04	0.04	0.03	0.03	100.00
HFC-236cb	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
HFC-236fa	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	100.00
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	0.03	0.04	0.03	0.03	0.03	0.04	0.06	0.06	0.07	0.10	0.12	0.12	0.12	100.00
HFC-365mfc	NO	NO	NO	NO	NO	NO	NO	NO	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	NO,IE	0.01	0.02	0.03	0.05	0.06	0.08	0.08	0.08	0.08	0.07	0.08	0.08	0.08	100.00
Unspecified mix of HFCs(4) - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Emissions of PFCs - (kt CO_2 equivalent)	4607.01	4607.01	4610.74	4603.28	3315.53	2164.43	1530.84	1410.40	1228.15	1660.52	1139.06	1287.06	1801.88	1727.62	1683.98	1713.85	1791.70	687.06	582.68	444.52	358.55	283.32	301.30	294.88	192.00	192.54	171.32	224.92	202.63	–95.60
CF_4	0.51	0.51	0.51	0.51	0.37	0.24	0.17	0.16	0.14	0.19	0.13	0.14	0.20	0.19	0.19	0.19	0.20	0.08	0.06	0.05	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.02	–96.45
C_2F_6	0.07	0.07	0.07	0.07	0.05	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	–91.63
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
c-C_4F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00

CTF Table 1.5

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change from base to latest reported year
	kt																													(%)
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
$C_{10}F_{18}$	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
c-C_3F_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Unspecified mix of PFCs(4) - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
Emissions of SF_6 - (kt CO_2 equivalent)	220.56	220.56	239.34	258.11	276.87	295.61	316.21	289.10	266.77	240.21	211.29	212.43	218.80	225.10	229.11	230.66	196.22	186.07	175.13	163.32	146.99	142.74	140.79	147.50	141.83	155.17	170.94	185.85	176.22	−20.10
SF_6	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	−20.10
Emissions of NF_3 - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00

a The column 'Base year' should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the Conference of the Parties. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

b Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO2 equivalent emissions.

c In accordance with the 'Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories', HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

CTF Table 2(a) Description of the Quantified Economy-wide Emissions Reduction Target: Base year and target

Base year/ base period[a]	2000
Emission reductions target (% of base year/base period)	5.00%
Emission reductions target (% of 1990)	15.6%
Period for reaching target	2013–2020

a Reporting by a developed country Party on the information specifed in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantifed economy-wide emission reduction targets.

CTF Table 2(b) Description of the Quantified Economy-wide Emissions Reduction Target: Gases covered

Gases covered	Covered	Base Year	GWP reference source
CO_2	Yes	2000	4th AR
CH_4	Yes	2000	4th AR
N_2O	Yes	2000	4th AR
HFCs	Yes	2000	4th AR
PFCs	Yes	2000	4th AR
SF_6	Yes	2000	4th AR
NF_3	Yes	2000	4th AR
Other Specify[a]			

Abbreviations: GWP = global warming potential
a Specify other gases

CTF Table 2(c) Description of the Quantified Economy-wide Emissions Reduction Target: Sectors covered

Sectors covered	Covered
Energy	Yes
Transport[f]	Yes
Industrial processes[g]	Yes
Agriculture	Yes
LULUCF	Yes
Waste	Yes
Other Specify	

Abbreviations: LULUCF = land use, land-use change and forestry.
a Transport is reported as a subsector of the energy sector.
b Industrial processes refer to the industrial processes and product use sectors.
c Specify other sectors

CTF Table 2(d) Description of the Quantified Economy-wide Emissions Reduction Target: Role of the LULUCF sector

LULUCF in base year level and target	Included
Contribution of LULUCF is calculated using	Activity-based approach*

*Based on KP-LULUCF classification system: Deforestation, afforestation, reforestation, forest management, cropland management, grazing land management and revegetation

CTF Table 2(e)I: Description of Quantified Economy-wide Emission Reduction Target: market-based mechanisms

Units	
Possible scale of contributions of market-based mechanisms under the convention *(estimated kt CO_2 eq)*	See CTF Table 2(f)
CERs	As above
ERUs	As above
AAUs[b]	As above
Carry-over units[c]	As above
Other mechanism units under the Convention (specify)[d]	As above

Abbreviations: AAU = assigned amount unit, CER = certified emission reduction, ERU = emission reduction unit.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b AAUs issued to or purchased by a Party.

c Units carried over from the first to the second commitment periods of the Kyoto Protocol, as described in decision 13/CMP.1 and consistent with decision XX /CMP.8.

d As indicated in paragraph 5(e) of the guidelines contained in annex I of decision 2/CP.17.

CTF Table 2(e)II: Description of quantified economy-wide emission reduction target

Other market-based mechanisms	
Possible scale of contributions of other market-based mechanisms (estimated kt CO_2 eq)	

CTF Table 2(f): Description of quantified economy-wide emission reduction target:any other information[a,b]

Any other information	
Any other information	Australia's quantified economy-wide emission reduction target is unconditional. Australia's *Emissions Projections 2019* reported Australia is on track to overachieve its 2020 target by 283 Mt CO_2-e without use of AAUs carried over from the first commitment period (CP1) of the Kyoto Protocol. The projected overachievement includes use of 28 Mt CO_2-e CERs transferred to the Australian Government by landfill operators under the Waste Industry Protocol. If CP1 AAU carry over is included, Australia's is projected to overachieve on its 2020 target by 411 Mt CO_2-e. (see Chapter 5 for more information on Australia's emissions projections)

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b This information could include information on the domestic legal status of the target or the total assigned amount of emission units for the period for reaching a target. Some of this information is presented in the narrative part of the biennial report.

CTF Table 3 Progress in achievement of the Quantified Economy-wide Emission Reduction Target: information on mitigation actions and their effects

Name of mitigation action[a]	Included in with measures GHG projection scenario	Sectors affected[b]	GHGs affected	Objective and/or activity affected	Type of instrument[c]	Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Mitigation impact[f] Estimate of mitigation impact in 2020 (not cumulative) (kt CO_2 eq)
Emission Reduction Fund (Crediting and Purchasing)	Yes	Cross-cutting	CH_4, CO_2, N_2O,	To help meet Australia's emissions reduction targets	Other (Voluntary Agreement)	Implemented	The ERF purchases abatement from eligible projects that are estimated using approved methods. Funds are allocated through reverse auctions, following which the Government contracts with successful bidders for the delivery of abatement.	2015	Clean Energy Regulator	5,053
Emission Reduction Fund (Safeguards)	Yes	Cross-cutting	CH_4, CO_2, N_2O,	To ensure purchased abatement is not offset by significant increases in emissions above business-as-usual levels elsewhere in the economy	Regulatory	Implemented	The safeguard mechanism achieves its objective by placing an emissions limit on Australia's largest emitting facilities.	2016	Clean Energy Regulator	Not estimated The mitigation impact would be calculated as the difference between emissions above the baseline and the safeguard baseline, if this was to occur.
Hydrofluorocarbon Phase-down	Yes	Cross-cutting	HFCs	To reduce greenhouse gas emissions from HVAC equipment	Other (Regulatory)	Implemented	The end use controls restrict access and use of synthetic greenhouse gases in these industries to licensed businesses and technicians who have the skills to minimise preventable emissions. This approach, combined with mandatory product stewardship for refrigerants and bans on disposable cylinders reduced emissions.	2018	Department of the Environment and Energy	Zero, the impact of this measures is estimated to be after 2020.

CTF Table 3

CTF Table 3

Name of mitigation action[a]	Included in with measures GHG projection scenario	Sectors affected[b]	GHGs affected	Objective and/or activity affected	Type of instrument[c]	Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Mitigation impact[f] Estimate of mitigation impact in 2020 (not cumulative) (kt CO_2 eq)
Renewable Energy Target	Yes	Energy	CO_2 CH_4 N_2O	To reduce greenhouse gas emissions in the electricity sector and encourage greater electricity generation from renewable sources	Other (Regulatory)	Implemented	This scheme creates a guaranteed market for additional renewable energy deployment using a mechanism of tradable certificates that are created by renewable energy generators (such as wind farms) and owners of small-scale renewable energy systems (such as solar PV).	2000	Clean Energy Regulator	19,838 (Large scale renewable energy target only)
Clean Energy Finance Corporation	Yes	Cross-cutting	CH_4, CO_2, HFCs, NF_3, PFCs, SF_6	To facilitate increased flows of finance into the low-emissions energy sector	Fiscal	Implemented	The Corporation administers AUD 10 billion of legislated funding to drive the commercial deployment of new low-emissions technologies through addressing financing barriers in clean energy markets. The CEFC co-finances clean energy projects with the private sector, working with the market to build industry capacity.	2012	Clean Energy Finance Corporation	7,320 The CEFC's activities are an enabler for greenhouse gas emission reduction. This abatement does not occur independently of complementary policies such as the RET.
Australian Renewable Energy Agency	Yes	Energy, Industry/ industrial processes	CH_4, CO_2, HFCs, N_2O, NF_3, PFCs, SF_6	To improve the competitiveness of renewable energy technologies and increase the supply of renewable energy in Australia.	Other (Research)	Implemented	The Agency is responsible for administering around AUD 2.4 billion of funding for: the research, development, demonstration, deployment and commercialisation of renewable energy and related technologies; and the storage and sharing of knowledge and information about renewable energy technologies.	2012	Australian Renewable Energy Agency	1,420 The ARENA's activities are an enabler for greenhouse gas emission reduction. This abatement does not occur independently of complementary policies such as the RET.

Name of mitigation action[a]	Included in with measures GHG projection scenario	Sectors affected[b]	GHGs affected	Objective and/or activity affected	Type of instrument[c]	Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Mitigation impact[f] Estimate of mitigation impact in 2020 (not cumulative) (kt CO_2 eq)
Equipment Energy Efficiency	Yes	Energy	CO_2, HFCs CH_4 N_2O	To improve the energy efficiency of appliances and equipment in the residential, commercial and industrial sectors	Education Information Regulatory	Implemented	Mandatory Minimum Energy Performance Standards and mandatory Energy Rating Labels improve energy productivity and reduce energy consumed, thereby saving businesses and households money from their energy bills. Improved energy productivity and reduced energy consumption in turn reduces greenhouse emissions.	1992	Department of Industry, Innovation and Science	6,227
Australia's National Construction Code	Yes	Other (Construction), Energy	CO_2 CH_4 N_2O	To reduce energy usage in new housing, multi-unit residential and non-residential buildings.	Other (Regulatory)	Implemented	The National Construction Code sets energy efficiency standards for new housing, multi-unit residential and non-residential buildings.	2003 (amended in 2010)	Department of Industry, Innovation and Science	Not estimated
Nationwide House Energy Rating Scheme	Yes	Other (Residential buildings), Energy	CO_2 CH_4 N_2O	To influence energy consumption by educating consumers about the energy efficiency of homes.	Information	Implemented	Provides the methodology to estimate and rate the potential thermal performance of residential buildings	2010 (updated in 2015)	Department of Industry, Innovation and Science, in cooperation with States and Territories	Not estimated

CTF Table 3

Name of mitigation action[a]	Included in with measures GHG projection scenario	Sectors affected[b]	GHGs affected	Objective and/or activity affected	Type of instrument[c]	Status of implementation[d]	Brief description[e]	Start year of implementation	Implementing entity or entities	Mitigation impact[f] Estimate of mitigation impact in 2020 (not cumulative) (kt CO_2 eq)
Commercial Building Disclosure Program	Yes	Energy	CO_2 CH_4 N_2O	To allow commercial building purchasers, lessors or tenants to compare the energy performance of commercial office stock	Other (Regulatory)	Implemented	The program provides a large, publicly available database of office building performance that encourages benchmarking and identifies opportunities for energy efficiency services.	2010	Department of Industry, Innovation and Science	381
National Australian Built Environment Rating System (NABERS)	Yes	Other (Commercial buildings)	CO_2 CH_4 N_2O	To provide better information of environmental performance of commercial buildings	Other (Regulatory)	Implemented	A rating system that measures the environmental performance of Australian buildings, tenancies and homes including energy efficiency, water usage, waste management and indoor environment quality.	1998	New South Wales Office of Environment and Heritage on behalf of Federal, State and Territory governments	Not estimated
Climate Active Carbon Neutral Certification	Yes	Cross-cutting	CH_4, CO_2, HFCs, N_2O, NF_3, PFCs, SF_6	To assist consumers to identify carbon neutral suppliers and products.	Other (Voluntary Agreement)	Implemented	Allows organisations, products and events to be certified by the Australian Government as carbon neutral, by reporting and offsetting their emissions. Eligible offsets are defined under the National Carbon Offset Standard.	2010	Department of the Environment and Energy	Not estimated
Carbon Capture and Storage Flagships Program	No	Energy, Industry/ industrial processes	CO_2	To improve the viability of Carbon Capture and Storage technology	Research	Implemented	Support for a small number of demonstration projects that will capture carbon dioxide emissions from industrial processes and safely store them underground in stable geological formations.	2009	Department of Industry, Innovation and Science	Not estimated

Note: The two final columns specify the year identified by the Party for estimating impacts (based on the status of the measure and whether an ex post or ex ante estimation is available).

Abbreviations: GHG = greenhouse gas; LULUCF = land use, land-use change and forestry.

a Parties should use an asterisk (*) to indicate that a mitigation action is included in the 'with measures' projection.

b To the extent possible, the following sectors should be used: energy, transport, industry/industrial processes, agriculture, forestry/LULUCF, waste management/waste, other sectors, cross-cutting, as appropriate.

c To the extent possible, the following types of instrument should be used: economic, fiscal, voluntary agreement, regulatory, information, education, research, other.

d To the extent possible, the following descriptive terms should be used to report on the status of implementation: implemented, adopted, planned.

e Additional information may be provided on the cost of the mitigation actions and the relevant timescale.

f Optional year or years deemed relevant by the Party.

(1) The annual abatement from the Emissions Reduction Fund for the year 2020 is not publicly available so as not to disclose commercially sensitive information that could impact delivery schedules and future auctions. However the cumulative abatement estimate for the Emissions Reduction Fund for the period to 2020 is 92 Mt CO2-e as outlined in the factsheet available at http://www.environment.gov.au/climate-change/climate-science-data/emissions-projections

CTF Table 3

CTF Table 4 Reporting on progress

		2000	2010	2011	2012	2013	2014	2015	2016	2017
Total (without LULUCF) (1)	kt CO_2 eq	485,018.62	537,275.25	538,280.61	540,615.86	530,433.52	524,957.10	535,173.67	546,771.76	554,126.56
Contribution from LULUCF c	kt CO_2 eq	55,363.54	43,194.54	19,729.54	17,499.36	7,405.37	7,141.69	-7,120.08	-16,839.88	-23,285.66
Market-based mechanisms under the Convention (2)	number of units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	kt CO_2 eq	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other market-based mechanisms	number of units	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	kt CO_2 eq	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Abbreviation: GHG – greenhouse gas, LULUCF = land use, land use change and forestry.

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b For the base year, information reported on the emission reduction target shall include the following : (a) total GHG emissions, excluding emissions and removals from the LULUCF sector: (b) emissions and/or removals from the LULUCF sector based on the accounting approach identified taking into consideration any relevant decisions of the Conference of Parties and the activities and/or land that will be accounted for; (c) total GHG emissions, including emissions and removals from the LULUCF sector. For each reported year, information reported on progress made towards the emission reduction targets shall include, in addition to the information noted in paragraphs 9(a-c) of the UNFCCC biennial reporting guidelines for developed country Parties, information on the use of units from market-based mechanisms.

c Information in this column should be consistent with the information reported in table 4(a)I or 4(a)II, as appropriate. The Parties for which all relevant information on the LULUCF contribution is reported in table 1 of this common tabular format can refer to table 1.

(1) For this table, data for the year 2017 are consistent with Australia's National Inventory Report 2017. Data for the year 2018 can be made available upon finalisation of Australia's National Inventory Report 2018

(2) Australia understands surrender as distinct from holding

CTF Table 4(a)I: Progress in achieving the Quantified Economy-wide Emissions Reduction Targets—further information on mitigation actions relevant to the contribution of the land use, land-use change and forestry sector

	Unit	Net GHG emissions/removals from LULUCF categories	Base year/period or reference level value	Contribution from LULUCF for reported year	Cumulative contribution from LULUCF	Accounting approach
2017						
Total LULUCF	kt CO_2 eq					Other (See section 4.8 of BR for more details)
A. Forest land	kt CO_2 eq					
1. Forest land remaining forest land	kt CO_2 eq	–25,615.79	–11,022.71	–14,593.08	NA	
2. Land converted to forest land	kt CO_2 eq	–29,354.62	–13,436.63	–15,917.98	NA	
3. Other [g]	kt CO_2 eq					
B. Cropland	kt CO_2 eq					
1. Cropland remaining cropland	kt CO_2 eq	–2,246.19	–6,364.73	4,118.54	NA	
2. Land converted to cropland	kt CO_2 eq	315.64	3,138.05	–2,822.41	NA	
3. Other [g]	kt CO_2 eq					
C. Grassland	kt CO_2 eq					
1. Grassland remaining grassland	kt CO_2 eq	7,844.65	15,370.24	–7,525.59	NA	
2. Land converted to grassland	kt CO_2 eq	25,490.99	66,025.18	–40,534.18	NA	
3. Other g	kt CO_2 eq					
D. Wetlands	kt CO_2 eq					
1. Wetland remaining wetland	kt CO_2 eq	34.26	254.82	–220.56	NA	
2. Land converted to wetland	kt CO_2 eq	0.03	28.96	–28.93	NA	
3. Other [g]	kt CO_2 eq					
E. Settlements	kt CO_2 eq					

CTF Table 4(a)I

	Unit	Net GHG emissions/removals from LULUCF categories	Base year/period or reference level value	Contribution from LULUCF for reported year	Cumulative contribution from LULUCF	Accounting approach
1. Settlements remaining settlements	kt CO_2 eq	–24.33	17.35	–41.69	NA	Other (See section 4.8 of BR for more details)
2. Land converted to settlements	kt CO_2 eq	269.70	1,353.02	–1,083.32	NA	
3. Other g	kt CO_2 eq					
F. Other land	kt CO_2 eq					
1. Other land remaining other land	kt CO_2 eq	NA	NA	NA	NA	
2. Land converted to other land	kt CO_2 eq	NO	NO	NO	NA	
3. Other [g]	kt CO_2 eq					
G. Other	kt CO_2 eq					
Harvested wood products	kt CO_2 eq	IE	IE	IE	NA	

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry, NO = Not Occurring, NE = Not Estimated,

IE = Included Elsewhere and NA = Not Applicable

a Reporting by a developed country Party on the information specified in the common tabular format does not prejudge the position of other Parties with regard to the treatment of units from market-based mechanisms under the Convention or other market-based mechanisms towards achievement of quantified economy-wide emission reduction targets.

b Parties that use the LULUCF approach that is based on table 1 do not need to complete this table, but should indicate the approach in table 2. Parties should fill in a separate table for each year, namely 2014 and 2015, where 2017 is the reporting year.

c CTF table 4(a)I has been used to present Australia's LULUCF estimates, as it is a better option for reporting purposes than using CTF table 4(a)II. Each LULUCF classification field under the Convention is completed using net emission data according to the LULUCF classifications under the KP.

d For each category, enter the net emissions or removals reported in the most recent inventory submission for the corresponding inventory year. If a category differs from that used for the reporting under the Convention or its KP, explain in the biennial report how the value was derived.

e Enter one reference level or base year/period value for each category. Explain in the biennial report how these values have been calculated.

f If applicable to the accounting approach chosen. Explain in this biennial report to which years or period the cumulative contribution refers to.

g Label each accounting approach and indicate where additional information is provided within this biennial report explaining how it was implemented, including all relevant accounting parameters (i.e. natural disturbances, caps).

h Specify what was used for the category 'other'. Explain in this biennial report how each was defined and how it relates to the categories used for reporting under the Convention or its KP.

i Australia did not Elect this non-mandatory Activity for reporting.

(1) CTF table 4(a)I presents KP LULUCF classifications data against UNFCCC LULUCF classifications to demonstrate progress against Australia's 2020 target (QEERT). Data for the year 2017 are consistent with Australia's National inventory report 2017. Data for the year 2018 can be made available upon finalisation of Australia's National inventory report 2018 CTF table 4(a)I has been used to present Australia's LULUCF estimates, as it is a better option for reporting purposes than using CTF table 4(a)II. Each LULUCF classification field under the Convention is completed using net emission data according to the LULUCF classifications under the KP.

(2) Forest land remaining forest land includes forest lands managed for timber production.

(3) Land converted to forest land includes land converted to forest since 1990.

A Supplementary Table has been included in Australia's submission which presents KP LULUCF classifications data against KP LULUCF classifications to demonstrate progress against Australia's 2020 Target.

Supplementary Cancun 2020 target inventory: KP LULUCF classifications data against KP LULUCF classifications

	Unit	Base year/period or reference level valued	Net GHG emissions/ removals from LULUCF categoriesd	Contribution from LULUCF for reported year	Cumulative contribution from LULUCF[e]	Accounting Approach[f]
2017						
This table presents KP LULUCF classifications data against KP LULUCF classifications to demonstrate progress against Australia's 2020 QEERT						
Total KP LULUCF	kt CO_2 eq	55,364	–23,286	–78,649	–309,516	Other (See section 4.8 of BR for more details)
A. Article 3.3 Activities	kt CO_2 eq	57,109	–3,278	–60,387	–265,975	
A.1. Deforestation	kt CO_2 eq	70,545	26,076	–44,469	–198,664	
A.2. Afforestation/ Reforestation	kt CO_2 eq	–13,437	–29,355	–15,918	–67,310	
B. Article 3.4 Activities	kt CO_2 eq	–1,745	–20,007	–18,262	–43,542	
B.1. Forest Management	kt CO_2 eq	–11,023	–25,616	–14,593	–68,137	
B.2. Cropland Management	kt CO_2 eq	–6,365	–2,246	4,119	31,553	
B.3. Grazing land Management	kt CO_2 eq	15,370	7,845	–7,526	–5,733	
B.4. Revegetation	kt CO_2 eq	272	10	–262	–1,224	
B.5. Wetland drainage and rewetting(h)	kt CO_2 eq	NA	NA	NA	NA	NA
Australia did not elect this non-mandatory activity for reporting						

CTF Table 4(b) Reporting on progress

	Quantity of units	kt CO_2 eq
2017		
Kyoto Protocol Units [d]		
AAUs		
ERUs		
CERs		
tCERs		
lCERs		
Units from market-based mechanisms under the Convention [d, e]		
Units from other market-based mechanisms [d, e]		
Total		
2018		
Kyoto Protocol Units d		
AAUs		
ERUs		
CERs		
tCERs		
lCERs		
Units from market-based mechanisms under the Convention [d, e]		
Units from other market-based mechanisms [d, e]		
Total		

* 'Note: Australia understands surrender as distinct from holding. Surrender is when an entity or Party retires a unit for compliance purposes. No units had been surrendered by end 2018.'

CTF Table 5 Summary of key variables and assumptions used in the projections analysis

	Historical						Projected		
Key underlying assumptions	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Australia's population (thousands)	16,970	17,927	18,951	20,085	21,912	23,724	25,824	27,917	29,875
Gross domestic product – Real GDP (2019 AU$t)	0.8	0.9	1.1	1.3	1.5	1.7	1.9	2.2	2.5
Electricity generation – sent out (TWh)	133	147	181	214	238	236	242	246	254
Oil price (2019 AU$/bbl)		39	59	80	98	94	91	89	97
Coal production (Run of Mine, Mt)	241	287	366	461	544	643	634	637	659
LNG production (Mt)	2	7	8	11	18	25	82	79	87
Iron ore production (Mt)	110	137	159	251	422	776	907	945	1005
Aluminium production (Mt)	1.2	1.3	1.7	1.9	1.9	1.6	1.5	1.6	1.6
Iron and Steel production (Mt)	6.7	8.4	8.0	7.3	6.9	4.7	5.8	5.8	5.9
Residential gas consumption (PJ)	88	105	119	128	144	144	142	134	123
Commercial gas consumption (PJ)	34	43	50	44	48	49	48	45	42
Beef cattle (million heads)	22	23	24	25	24	25	24	25	25
Dairy cattle (million heads)	2.6	2.7	3.1	3.1	2.5	2.8	2.5	2.5	2.6
Solid waste disposal (kt)	16,468	17,421	19,594	20,574	19,916	18,711	16,973	14,565	13,126

CTF Table 6 Information on updated greenhouse gas projections under a 'with measures' scenario

	Historical – GHG emission and removal (kt CO_2-e)							Projected – GHG emission projections (kt CO_2-e)		
	Base year	1990	1995	2000	2005	2010	2015	2020	2025	2030
Sector										
Energy	290,164	232,616	250,569	290,164	317,423	331,359	325,035	333,850	304,574	295,623
Transport	74,128	61,395	68,269	74,128	82,212	88,778	95,268	101,611	106,688	108,224
Industry/ Industrial processes and product use	26,684	26,031	25,202	26,684	31,876	35,646	32,837	34,992	33,308	32,337
Agriculture	78,382	80,248	72,018	78,382	75,904	66,280	70,085	67,278	71,338	74,386
Forestry/ LULUCF	55,364	187,513	54,776	55,364	95,615	43,195	-7,120	-17,434	-19,021	-15,763
Waste management/ waste	15,661	20,026	18,854	15,661	14,387	15,213	11,949	11,719	10,913	10,732
Other	-	-	-	-	-	-	-	-	-	-
Gas										
CO_2 emissions including net CO_2 from LULUCF		448,921	346,676	389,107	466,484	434,509	382,868	390,106	368,106	360,944
CO_2 emissions excluding net CO_2 from LULUCF		278,424	305,410	350,195	386,515	406,426	402,538	414,331	394,897	382,847
CH_4 emissions including net CH_4 from LULUCF		133,274	121,799	125,331	119,805	113,556	110,732	109,590	107,676	113,518
CH_4 emissions excluding net CH_4 from LULUCF		120,081	111,416	112,761	107,933	102,501	101,348	104,512	102,136	108,927
N_2O emissions including net N_2O from LULUCF		19,381	18,363	22,830	24,136	23,368	22,309	19,572	20,890	21,533
N_2O emissions excluding net N_2O from LULUCF		15,558	15,236	18,950	20,363	19,312	19,144	17,859	19,021	19,984
HFCs		1,425	1,004	1,614	5,003	8,611	11,802	12,347	10,362	9,135

	Historical – GHG emission and removal (kt CO_2-e)							Projected – GHG emission projections (kt CO_2-e)		
	Base year	1990	1995	2000	2005	2010	2015	2020	2025	2030
PFCs		4,607	1,531	1,287	1,792	283	171	214	217	219
SF_6		221	316	212	196	143	171	186	189	191
Other (Specify e.g. NF_3)	-	-	-	-	-	-	-	-	-	-
Total with LULUCF		607,828	489,689	540,382	617,416	580,470	528,054	532,016	507,800	505,540
Total without LULUCF		420,315	434,913	485,019	521,801	537,275	535,174	549,450	526,821	521,303

** The historical and projected emissions above are presented on a KP accounting basis to show tracking towards Australia's Quantified Economy-wide Emission Reduction Target (QEERT). This is different to figures presented in Chapter 5, which are presented on a UNFCCC accounting basis.

CTF Table 7. Provision of public financial support: Summary 2016–2017

Allocation channels	Domestic currency					USD [b]				
	Core/ general (AUD) [c,1]	Climate-specific [d,2]				Core/ general (USD) [c,1]	Climate-specific [d]			
		Mitigation	Adaptation	Cross-cutting [e]	Other [f]		Mitigation	Adaptation	Cross-cutting [e]	Other [f]
Total contributions through multilateral channels	**418,826,621**			**121,654,754**		**330,496,087**			**95,997,767**	
Multilateral climate change funds [g]	54,800,000			47,998,304		43,242,680			37,875,462	
Other multilateral climate change funds [h]										
Multilateral financial institutions, including regional development banks	358,191,255			67,821,084		282,648,720			53,517,618	
Specialised United Nations bodies	5,835,366			5,835,366		4,604,687			4,604,687	
Total contributions through bilateral, regional and other channels		30,079,487	106,326,880	15,926,344			23,735,723	83,902,541	12,567,478	
Total	**418,826,621**	**30,079,487**	**106,326,880**	**137,581,098**		**330,496,087**	**23,735,723**	**83,902,541**	**108,565,245**	

CTF Table 7

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviation: USD = United States dollars.

b Parties should provide an explanation of the methodology used for currency exchange for the information provided in tables 7, 7(a) and 7(b) in the documentation box.

c This refers to support to multilateral institutions that Parties cannot specify as being climate-specific.

d Parties should explain in their biennial reports how they define funds as being climate-specific.

e This refers to funding for activities that are cross-cutting across mitigation and adaptation.

f Please specify.

g Multilateral climate change funds listed in paragraph 17(a) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

h Other multilateral climate change funds as referred to in paragraph 17(b) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).

Table 7b 'additional information' lists the names of bilateral, regional and global programs that include a climate finance component.

Documentation Box:

1: Core/general. The Australian financial year runs from 1 July to 30 June. Therefore, the figures for 2017 are for the period 1 July 2016 – 30 June 2017, and for 2018 are for the period 1 July 2017 – 30 June 2018. USD exchange rates are based on annual average conversion rates for the relevant financial year as published by the Australian Taxation Office: (FY2016/17: 0.7891 and FY 2017/18: 0.8113). Sources: Average rate for year ended 30 June 2017: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2017/ and Average rate for year ended 30 June 2018: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2018/

CTF Table 7. Provision of public financial support: Summary 2017–2018

Allocation channels	Domestic currency					USD [b]				
	Core/ general (AUD) [c,1]	Climate-specific [d,2]				Core/ general (USD) [c,1]	Climate-specific [d]			
		Mitigation	Adaptation	Cross-cutting [e]	Other [f]		Mitigation	Adaptation	Cross-cutting [e]	Other [f]
Total contributions through multilateral channels	**561,585,014**			**179,582,114**		**455,613,922**			**145,694,970**	
Multilateral climate change funds [g]	43,370,492			36,612,412		35,186,480			29,703,650	
Other multilateral climate change funds [h,2]	3,810,492			3,771,663		3,091,452			3,059,950	
Multilateral financial institutions, including regional development banks	509,018,184			133,773,364		412,966,453			108,530,331	
Specialised United Nations bodies	9,196,338			9,196,338		7,460,989			7,460,989	
Total contributions through bilateral, regional and other channels		22,537,408	113,968,336	8,233,239			18,284,599	92,462,511	6,679,627	
Total	**561,585,014**	**22,537,408**	**113,968,336**	**187,815,353**		**455,613,922**	**18,284,599**	**92,462,511**	**152,374,597**	

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviation: USD = United States dollars.

b Parties should provide an explanation of the methodology used for currency exchange for the information provided in tables 7, 7(a) and 7(b) in the documentation box.

c This refers to support to multilateral institutions that Parties cannot specify as being climate-specific.

d Parties should explain in their biennial reports how they define funds as being climate-specific.

e This refers to funding for activities that are cross-cutting across mitigation and adaptation.

f Please specify.

g Multilateral climate change funds listed in paragraph 17(a) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

h Other multilateral climate change funds as referred to in paragraph 17(b) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

CTF Table 7

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).

Documentation Box:

1: Core/general. The Australian financial year runs from 1 July to 30 June. Therefore, the figures for 2017 are for the period 1 July 2016 – 30 June 2017, and for 2018 are for the period 1 July 2017 – 30 June 2018. USD exchange rates are based on annual average conversion rates for the relevant financial year as published by the Australian Taxation Office: (FY2016/17: 0.7891 and FY 2017/18: 0.8113). Sources: Average rate for year ended 30 June 2017: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2017/ and Average rate for year ended 30 June 2018: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2018/

2: Global Green Growth Institute counted under 'multilateral climate change funds'

CTF Table 7(a): Provision of public financial support: Contribution through multilateral channels 2016–2017

Donor Funding	Total Amount				Status [b, 3]	Funding source [f, 4]	Financial instrument [f, 5]	Type of support [f, g, 6]	Sector [c, f, 7]
	Core/general [d, 1]		Climate-specific [e, 2]						
	Domestic Currency	USD	Domestic Currency	USD					
Total contributions through multilateral channels	**418,826,621**	**330,496,087**	**121,654,754**	**95,997,767**					
Multilateral climate change funds	**54,800,000**	**43,242,680**	**47,998,304**	**37,875,462**					
1. Global Environment Facility	19,800,000	15,624,180	12,998,304	10,256,962	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund	35,000,000	27,618,500	35,000,000	27,618,500	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds									
Multilateral financial institutions, including regional development banks	**358,191,255**	**282,648,720**	**67,821,084**	**53,517,618**					

CTF Table 7(a)

CTF Table 7(a)

Donor Funding	Total Amount: Core/general [d, 1] Domestic Currency	Total Amount: Core/general [d, 1] USD	Total Amount: Climate-specific [e, 2] Domestic Currency	Total Amount: Climate-specific [e, 2] USD	Status [b, 3]	Funding source [f, 4]	Financial instrument [f, 5]	Type of support [f, g, 6]	Sector [c, f, 7]
1. World Bank	201,122,255	158,705,572	43,607,327	34,410,542	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. International Finance Corporation									
3. African Development Bank									
4. Asian Development Bank	157,069,000	123,943,148	24,213,757	19,107,076	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
5. European Bank for Reconstruction and Development									
6. Inter-American Development Bank									
7. Other									
Specialised United Nations bodies	**5,835,366**	**4,604,687**	**5,835,366**	**4,604,687**					
1. United Nations Development Programme [8]									
2. United Nations Environment Programme [8]									
3. Other	5,835,366	4,604,687	5,835,366	4,604,687					
Intergovernmental Panel on Climate Change	253,000	199,642	253,000	199,642	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting

Donor Funding	Total Amount				Status [b, 3]	Funding source [f, 4]	Financial instrument [f, 5]	Type of support [f, g, 6]	Sector [c, f, 7]
	Core/general [d, 1]		Climate-specific [e, 2]						
	Domestic Currency	USD	Domestic Currency	USD					
Multilateral Fund for the Implementation of the Montreal Protocol	4,622,505	3,647,619	4,622,505	3,647,619	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
United Nations Framework Convention on Climate Change	959,861	757,426	959,861	757,426	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviation: USD = United States dollars.

b Parties should provide an explanation of the methodology used for currency exchange for the information provided in tables 7, 7(a) and 7(b) in the documentation box.

c This refers to support to multilateral institutions that Parties cannot specify as being climate-specific.

d Parties should explain in their biennial reports how they define funds as being climate-specific.

e This refers to funding for activities that are cross-cutting across mitigation and adaptation.

f Please specify.

g Multilateral climate change funds listed in paragraph 17(a) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

h Other multilateral climate change funds as referred to in paragraph 17(b) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).

Documentation Box:

1: Core/general. The Australian financial year runs from 1 July to 30 June. Therefore, the figures for 2017 are for the period 1 July 2016–30 June 2017, and for 2018 are for the period 1 July 2017–30 June 2018. USD exchange rates are based on annual average conversion rates for the relevant financial year as published by the Australian Taxation Office: (FY2016/17: 0.7891 and FY 2017/18: 0.8113). Sources: Average rate for year ended 30 June 2017: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2017/ and Average rate for year ended 30 June 2018: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2018/

Global programs refer to investments that deliver activities across multiple countries or regions.

2: Climate-specific. Australia sources its climate finance from new and additional aid budget appropriations passed by the Australian Parliament on an annual basis.
The methodology Australia employs to track climate finance expenditure is based on the Organisation for Economic Development and Cooperation (OECD) Development Assistance Committee (DAC) Rio statistical markers for climate change mitigation and adaptation. For contributions through multilateral channels Australia counts a percentage of its core contributions according to the imputed shares calculated by the OECD DAC.
For bilateral, regional and global programs, Australia assesses each activity to determine if it has an explicit climate change objective (based on OECD DAC guidance) and whether this is a primary or secondary objective. For an explanation of this methodology see Australia's 4th Biennial Report.

3: Status. Australia only reports on funds which have been disbursed, that is transferred to partner countries/organisations.

CTF Table 7(a)

4: Funding source

5: Financial instrument. Australia's climate finance contributions are wholly grant-based.

6: Type of support. Australia reports on all climate finance through multilateral channels as being cross-cutting. For bilateral, regional and global programs, Australia assess each activity to determine if the support is for adaptation, mitigation or cross-cutting. Most of Australia's country and regional programs, and its portfolio of global programs, contain a mix of mitigation and adaptation activities. Because the CTF table only allows one category to be selected, programs have been labelled as cross-cutting except where they are 100 per cent focused on either adaptation or mitigation. See Australia's 4th Biennial Report for a full explanation and more detailed breakdown of the split between adaptation, mitigation and cross-cutting.

7: Sector. Australia allocates sectors in the BR based on OECD DAC Sector Codes assigned when aid activities are established. Other sectors have been specified where Australia's climate finance is significant, for example Environmental Policy and Administrative Management categorised as 'Environment'. Other (Other Sectors) refers to additional sectors reported on under DAC guidance which are not captured by the BR sector options and where Australia's climate finance is relatively modest, for example health and education. All funds disbursed through multilateral channels are classified as 'cross-cutting' to reflect a broad range of sectors.

8. Australia makes core contributions to UNDP. However, the OECD DAC does not currently calculate an imputed share for UNDP. In the absence of a robust calculation method, Australia does not count a portion of our core contribution as climate finance.

CTF Table 7(a): Provision of public financial support: Contribution through multilateral channels 2017–2018

Donor Funding	Total Amount				Status [b, 3]	Funding source [f, 4]	Financial instrument [f, 5]	Type of support [f, g, 6]	Sector [c, f, 7]
	Core/general [d, 1]		Climate-specific [e, 2]						
	Domestic Currency	USD	Domestic Currency	USD					
Total contributions through multilateral channels	**561,585,014**	**455,613,922**	**179,582,114**	**145,694,970**					
Multilateral climate change funds	**43,370,492**	**35,186,480**	**36,612,412**	**29,703,650**					
1. Global Environment Facility	19,560,000	15,869,028	12,840,749	10,417,700	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
2. Least Developed Countries Fund									
3. Special Climate Change Fund									
4. Adaptation Fund									
5. Green Climate Fund	20,000,000	16,226,000	20,000,000	16,226,000	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
6. UNFCCC Trust Fund for Supplementary Activities									
7. Other multilateral climate change funds									
Global Green Growth Institute	3,810,492	3,091,452	3,771,663	3,059,950	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
Multilateral financial institutions, including regional development banks	**509,018,184**	**412,966,453**	**133,773,364**	**108,530,331**					
1. World Bank	177,523,500	144,024,816	38,488,551	31,225,761	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting

CTF Table 7(a)

CTF Table 7(a)

Donor Funding	Total Amount				Status [b, 3]	Funding source [f, 4]	Financial instrument [f, 5]	Type of support [f, g, 6]	Sector [c, f, 7]
	Core/general [d, 1]		Climate-specific [e, 2]						
	Domestic Currency	USD	Domestic Currency	USD					
2. International Finance Corporation									
3. African Development Bank									
4. Asian Development Bank	166,479,561	135,064,868	25,664,489	20,821,600	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
5. European Bank for Reconstruction and Development									
6. Inter-American Development Bank									
7. Other									
Asian Infrastructure Investment Bank	165,015,123	133,876,769	69,618,230	56,481,270	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
Specialised United Nations bodies	**9,196,338**	**7,460,989**	**9,196,338**	**7,460,989**					
1. United Nations Development Programme 8									
2. United Nations Environment Programme									
3. Other	9,196,338	7,460,989	9,196,338	7,460,989					
Intergovernmental Panel on Climate Change	313,000	253,937	313,000	253,937	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting

Donor Funding	Total Amount				Status [b, 3]	Funding source [f, 4]	Financial instrument [f, 5]	Type of support [f, g, 6]	Sector [c, f, 7]
	Core/general [d, 1]		Climate-specific [e, 2]						
	Domestic Currency	USD	Domestic Currency	USD					
Multilateral Fund for the Implementation of the Montreal Protocol	7,833,905	6,355,647	7,833,905	6,355,647	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting
United Nations Framework Convention on Climate Change	1,049,433	851,405	1,049,433	851,405	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviation: USD = United States dollars.

b Parties should provide an explanation of the methodology used for currency exchange for the information provided in tables 7, 7(a) and 7(b) in the documentation box.

c This refers to support to multilateral institutions that Parties cannot specify as being climate-specific.

d Parties should explain in their biennial reports how they define funds as being climate-specific.

e This refers to funding for activities that are cross-cutting across mitigation and adaptation.

f Please specify.

g Multilateral climate change funds listed in paragraph 17(a) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

h Other multilateral climate change funds as referred to in paragraph 17(b) of the 'UNFCCC biennial reporting guidelines for developed country Parties' in decision 2/CP.17.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).

Documentation Box:

1: Core/general. The Australian financial year runs from 1 July to 30 June. Therefore, the figures for 2017 are for the period 1 July 2016–30 June 2017, and for 2018 are for the period 1 July 2017–30 June 2018.

USD exchange rates are based on annual average conversion rates for the relevant financial year as published by the Australian Taxation Office: (FY2016/17: 0.7891 and FY 2017/18: 0.8113). Sources: Average rate for year ended 30 June 2017: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2017/ and Average rate for year ended 30 June 2018: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2018/

Global programs refer to investments that deliver activities across multiple countries or regions.

2: Climate-specific. Australia sources its climate finance from new and additional aid budget appropriations passed by the Australian Parliament on an annual basis.
The methodology Australia employs to track climate finance expenditure is based on the Organisation for Economic Development and Cooperation (OECD) Development Assistance Committee (DAC) Rio statistical markers for climate change mitigation and adaptation. For contributions through multilateral channels Australia counts a percentage of its core contributions according to the imputed shares calculated by the OECD DAC.

For bilateral, regional and global programs, Australia assesses each activity to determine if it has an explicit climate change objective (based on OECD DAC guidance) and whether this is a primary or secondary objective. For an explanation of this methodology see Australia's 4th Biennial Report.

3: Status. Australia only reports on funds which have been disbursed, that is transferred to partner countries/organisations.

CTF Table 7(a)

4: Funding source

5: Financial instrument. Australia's climate finance contributions are wholly grant-based.

6: Type of support. Australia reports on all climate finance through multilateral channels as being cross-cutting. For bilateral, regional and global programs, Australia assess each activity to determine if the support is for adaptation, mitigation or cross-cutting. Most of Australia's country and regional programs, and its portfolio of global programs, contain a mix of mitigation and adaptation activities. Because the CTF table only allows one category to be selected, programs have been labelled as cross-cutting except where they are 100 per cent focused on either adaptation or mitigation. See Australia's 4th Biennial Report for a full explanation and more detailed breakdown of the split between adaptation, mitigation and cross-cutting.

7: Sector. Australia allocates sectors in the BR based on OECD DAC Sector Codes assigned when aid activities are established. Other sectors have been specified where Australia's climate finance is significant, for example Environmental Policy and Administrative Management categorised as 'Environment'. Other (Other Sectors) refers to additional sectors reported on under DAC guidance which are not captured by the BR sector options and where Australia's climate finance is relatively modest, for example health and education. All funds disbursed through multilateral channels are classified as 'cross-cutting' to reflect a broad range of sectors.

8. Australia makes core contributions to UNDP. However, the OECD DAC does not currently calculate an imputed share for UNDP. In the absence of a robust calculation method, Australia does not count a portion of our core contribution as climate finance.

CTF Table 7(b) Provision of public financial support: Contribution through bilateral, regional and other channels 2016–17

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Total contributions through bilateral, regional and other channels	**152,332,711**	**120,205,742**						
Global (ODA)	23,127,170	18,249,650	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Disaster prevention and preparedness Environment Energy Other Sectors Transport Water and sanitation	• Australia Awards • Australian NGO Cooperation Program • Australian Red Cross Humanitarian Partnership • Australian Volunteers • Australian Water Partnership • Asian Sports Partnerships programs • Benefit Sharing Fund and development projects • Capacity Building for Transparency (CBIT) Fund • Civil Society WASH Fund • Climate Risk and Early Warning Systems Initiative • Global Crop Diversity Trust • Global Network Support to Sendai Framework • Blue Carbon Symposium (CSIRO) • Innovation Resource Facility • MIKTA - Education in Emergencies • Nationally Determined Contribution Partnership

CTF Table 7(b)

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
								• ODE Evaluation Program • Private Financing Advisory Network • Supporting Implementation of Sendai (UNDRR) • The Private Infrastructure Development Group • WASH and Water Management Capacity Building Work Stream • Water and Sanitation Initiative Global Programming • World Bank Global Facility for Disaster Risk Reduction
Global (OOF)	1,782,281	1,406,398	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting	• International Climate Change Engagement Program
Pacific Regional	17,112,866	13,503,763	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting Disaster prevention and preparedness Environment Other sectors	• Climate and Oceans Support Program in the Pacific • Fisheries Development Assistance in the Pacific • Green Climate Fund Board Meetings Support • Investing in a Resilient Pacific • Pacific Risk Resilience Program • Pacific Women Climate Change Negotiators Training • Secretariat of the Pacific Regional Environment Programme Partnership Agreement

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Fiji	8,898,000	7,021,412	Disbursed	ODA	Grant	Cross-cutting	Environment Other sectors	• Fiji Access to Quality Education Program • Fiji Community Development Program • Pacific Women Fiji Country Plan • Response to Tropical Cyclone Winston • Support for Fiji's Presidency of COP23
Kiribati	4,809,712	3,795,344	Disbursed	ODA	Grant	Cross-cutting	Environment Other sectors	• Kiribati Adaptation Project Phase III • Kiribati Growth and Economic Management Initiative • Kiribati Education Improvement Program • The Kiribati Facility
Marshall Islands	340,000	268,294	Disbursed	ODA	Grant	Adaptation	Water and sanitation	• RMI Partnership for Development
Nauru	1,700,000	1,341,470	Disbursed	ODA	Grant	Adaptation	Transport Other sectors	• Nauru Infrastructure and Services

CTF Table 7(b)

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Papua New Guinea	39,532,644	31,195,209	Disbursed	ODA	Grant	Cross-cutting	Disaster prevention and preparedness Other Sectors Transport	• Health and Education Procurement Facility • Joint Understanding Technical Enabling Unit • PNG-Australia Incentive Fund • PNG Governance Facility • PNG Health and HIV Multilateral Partnerships • PNG Transport Sector Support Program Phase 2 • PNG United Nations Country Fund
Samoa	700,000	552,370	Disbursed	ODA	Grant	Adaptation	Other sectors Transport	• Samoa Economic Infrastructure • Samoa Economic Reform Program
Solomon Islands	14,147,222	11,163,573	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting Disaster prevention and preparedness Energy Environment Other sectors Transport Water and sanitation	• Education Sector Program • Solomon Islands Disaster Risk Response • Solomon Islands Energy Sector – Tina River Hydro • Solomon Islands Growth Program • Solomon Islands Rural Development Program • S olomon Islands Transport Sector-Based Approach Phase 2 • Solomon Islands Urban Water Supply

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Tonga	2,060,467	1,625,915	Disbursed	ODA	Grant	Cross-cutting	Disaster prevention and preparedness Energy Other sectors Water and sanitation	• Disaster Preparedness and Response • Nuku'alofa Urban Development Sector Project • Tonga Economic and Public Sector Reform Program • Tonga Energy Roadmap/Outer Island Renewable Energy Project
Tuvalu	254,918	201,155	Disbursed	ODA	Grant	Adaptation	Cross-cutting Environment Other sectors	• Good Governance and Economic Growth Initiative • Pacific Technical Assistance Mechanism
Vanuatu	4,780,000	3,771,898	Disbursed	ODA	Grant	Adaptation	Other sectors Transport	• Port Vila Urban Development Project • Vanuatu Education Support Program • Vanuatu Health Sector Support • Vanuatu Skills for Economic Growth Phase IV • Vanuatu Transport Sector Support Program Phase 2
South and West Asia Regional	3,480,848	2,746,737	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Energy Water and sanitation	• Sustainable Development Investment Portfolio Phase 2
Afghanistan	1,566,277	1,235,949	Disbursed	ODA	Grant	Adaptation	Other Sectors	• Australia Afghanistan Community Resilience Scheme

CTF Table 7(b)

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Bangladesh	2,157,700	1,702,641	Disbursed	ODA	Grant	Cross-cutting	Other Sectors	• Strategic Partnership Arrangement Phase 2 with Building Resources Across Communities (BRAC) • Support to Vulnerable Communities in Cox's Bazar
Pakistan	600,000	473,460	Disbursed	ODA	Grant	Cross-cutting	Other Sectors	• Pakistan Humanitarian Support
East Asia Regional	2,240,058	1,767,630	Disbursed	ODA	Grant	Cross-cutting	Agriculture Energy Water and sanitation	• Greater Mekong Water Resources Program • Grow Asia (World Economic Forum) • IFC Sustainable Hydropower in the Mekong Countries • Oxfam-Civil Society Engagement in Water Governance • Research for Development on Water Governance
Cambodia	5,881,264	4,640,906	Disbursed	ODA	Grant	Cross-cutting	Agriculture Environment	• Cambodia Agricultural Value Chain Program Phase II • Cambodia Environment Code Part 2

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Indonesia	16,929,355	13,358,954	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Disaster prevention and preparedness Energy Environment Other sectors Transport Water and sanitation	• Australia Indonesia Partnership for Rural Economic Development program • Disaster Response and Preparedness in Indonesia • Governance for Growth KOMPAK • Indonesia Australia Partnership for Environmental Governance • Indonesia Infrastructure Initiative • Indonesia Infrastructure Program (KIAT) • MDB Infrastructure Assistance Program
Myanmar	69,059	54,494	Disbursed	ODA	Grant	Cross-cutting	Other sectors	• Livelihoods and Food Security Trust Fund
Vietnam	162,869	128,520	Disbursed	ODA	Grant	Adaptation	Transport	• Cao Lanh Bridge project

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollars.

b Parties should report, to the extent possible, on details contained in this table.

c Parties should explain, in their biennial reports, the methodologies used to specify the funds as disbursed and committed. Parties will provide the information for as many status categories as appropriate in the following order of priority: disbursed and committed.

d Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under 'Other'.

e Parties should report, as appropriate, on project details and the implementing agency.

f Parties should explain in their biennial reports how they define funds as being climate-specific.

g Please specify.

h This refers to funding for activities that are cross-cutting across mitigation and adaptation.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).

CTF Table 7(b)

Documentation Box:

1: Core/general. The Australian financial year runs from 1 July to 30 June. Therefore, the figures for 2017 are for the period 1 July 2016–30 June 2017, and for 2018 are for the period 1 July 2017–30 June 2018. USD exchange rates are based on annual average conversion rates for the relevant financial year as published by the Australian Taxation Office: (FY2016/17: 0.7891 and FY 2017/18: 0.8113). Sources: Average rate for year ended 30 June 2017: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2017/ and Average rate for year ended 30 June 2018: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2018/

Global programs refer to investments that deliver activities across multiple countries or regions.

2: Climate-specific. Australia sources its climate finance from new and additional aid budget appropriations passed by the Australian Parliament on an annual basis.
The methodology Australia employs to track climate finance expenditure is based on the Organisation for Economic Development and Cooperation (OECD) Development Assistance Committee (DAC) Rio statistical markers for climate change mitigation and adaptation.

For contributions through multilateral channels Australia counts a percentage of its core contributions according to the imputed shares calculated by the OECD DAC.
For bilateral, regional and global programs, Australia assesses each activity to determine if it has an explicit climate change objective (based on OECD DAC guidance) and whether this is a primary or secondary objective. For an explanation of this methodology see Australia's 4th Biennial Report.

3: Status. Australia only reports on funds which have been disbursed, that is transferred to partner countries/organisations.

4: Funding source

5: Financial instrument. Australia's climate finance contributions are wholly grant-based.

6: Type of support. Australia reports on all climate finance through multilateral channels as being cross-cutting.
For bilateral, regional and global programs, Australia assess each activity to determine if the support is for adaptation, mitigation or cross-cutting.
Most of Australia's country and regional programs, and its portfolio of global programs, contain a mix of mitigation and adaptation activities. Because the CTF table only allows one category to be selected, programs have been labelled as cross-cutting except where they are 100 per cent focused on either adaptation or mitigation. See Australia's 4th Biennial Report for a full explanation and more detailed breakdown of the split between adaptation, mitigation and cross-cutting.

7: Sector. Australia allocates sectors in the BR based on OECD DAC Sector Codes assigned when aid activities are established. Other sectors have been specified where Australia's climate finance is significant, for example Environmental Policy and Administrative Management categorised as 'Environment'. Other (Other Sectors) refers to additional sectors reported on under DAC guidance which are not captured by the BR sector options and where Australia's climate finance is relatively modest, for example health and education.

All funds disbursed through multilateral channels are classified as 'cross-cutting' to reflect a broad range of sectors.

8: Table 7b 'additional information' lists the names of bilateral, regional and global programs that include a climate finance component.

CTF Table 7(b) Provision of public financial support: Contribution through bilateral, regional and other channels 2017–2018

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	Total Amount Climate-specific [f, 2] USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Total contributions through bilateral, regional and other channels	**144,738,984**	**117,426,738**						
Global (ODA)	22,837,116	18,527,752	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Disaster prevention and preparedness Energy Environment Other sectors Water and sanitation	• AgResults • Australia Awards • Australian Humanitarian Partnership • Australian NGO Cooperation Program • Australian Red Cross Humanitarian Partnership • Australian Volunteers • Australian Water Partnership • Business Partnership Platform • Capacity Building for Transparency (CBIT) Fund • Climate Risk and Early Warning Systems Initiative • Exporting Australian Traditional Fire Management • Geoscience support for Sendai Implementation • Global Crop Diversity Trust • Partnership for Renewable Energy Finance and Trade

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
								• Private Financing Advisory Network • Scaling Frontier Innovations and Entrepreneurship • Supporting Implementation of the Sendai Framework • Water and Sanitation Initiative Global Programming • World Bank Global Facility for Disaster Risk Reduction
Global (OOF)	1,637,567	1,328,558	Disbursed	OOF	Grant	Cross-cutting	Cross-cutting	• International Climate Change Engagement Program
Pacific Regional	15,651,945	12,698,423	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting Disaster prevention and preparedness Environment Other sectors	• Benefit Sharing Fund and development projects • Climate and Oceans Support Program in the Pacific • Fisheries Development Assistance in the Pacific • Green Climate Fund - Pacific Regional Dialogue • Investing in a Resilient Pacific 2016-2018 • Pacific Regional Blue Carbon Initiative • Pacific Risk Resilience Program

Recipient country/ region/project/ program/activity [b]	Total Amount			Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
	Climate-specific [f, 2]							
	Domestic Currency AUD	USD	Status [c, 3]					
								• Pacific Women Climate Change Negotiators Training • Pacific Women Shaping Pacific Development • Secretariat of the Pacific Regional Environment Programme Partnership Agreement
Fiji	3,765,592	3,055,025	Disbursed	ODA	Grant	Cross-cutting	Disaster prevention and preparedness Other Sectors	• Fiji Access to Quality Education Program • Fiji Program Support Facility Preparedness and Response Fund • Supporting Private Sector Development in Fiji
Kiribati	4,424,949	3,589,961	Disbursed	ODA	Grant	Cross-cutting	Other sectors	• Kiribati Education Improvement Program • Kiribati Growth and Economic Management Initiative • The Kiribati Facility
Marshall Islands	281,362	228,269	Disbursed	ODA	Grant	Adaptation	Water and sanitation	• RMI Partnership for Development
Nauru	2,164,497	1,756,057	Disbursed	ODA	Grant	Adaptation	Infrastructure Other sectors Transport	• Nauru Infrastructure and Services

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Papua New Guinea	32,421,592	26,303,638	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Environment Other Sectors Transport	• Food Systems Initiative • Health and Education Procurement Facility • Health Services Sector Development Program • Joint Understanding Technical Enabling Unit • PNG-Australia Incentive Fund • PNG Food Security and Climate Adaptation Projects • PNG Transport Sector Support Program Phase 2 • Private Sector and Rural Development
Samoa	380,910	309,032	Disbursed	ODA	Grant	Adaptation	Cross-cutting Other sectors Transport	• Samoa Economic Infrastructure • Samoa Economic Reform Program • Samoa Governance Program

Recipient country/ region/project/ program/activity [b]	Total Amount			Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
	Climate-specific [f, 2]							
	Domestic Currency AUD	USD	Status [c, 3]					
Solomon Islands	13,838,459	11,227,142	Disbursed	ODA	Grant	Cross-cutting	Cross-cutting Disaster prevention and preparedness Energy Other sectors Transport	• Education Sector Program • Gender Inequality of Risk - Pacific Islands • Solomon Islands Governance Program • Solomon Islands Growth Program • Solomon Islands Humanitarian and Disaster Management • Solomon Islands Rural Development Program • Solomon Islands Transport Sector-Based Approach Phase 2
Tonga	1,503,136	1,219,494	Disbursed	ODA	Grant	Cross-cutting	Disaster prevention and preparedness Other sectors Water and sanitation	• Disaster Preparedness and Response • Nuku'alofa Urban Development Sector Project • Tonga Economic and Public Sector Reform Program
Tuvalu	1,102,001	894,053	Disbursed	ODA	Grant	Adaptation	Cross-cutting Environment Other sectors	• Australian Government Support to Tuvalu Education • Good Governance and Economic Growth Initiative • Pacific Technical Assistance Mechanism

CTF Table 7(b)

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Vanuatu	5,734,074	4,652,054	Disbursed	ODA	Grant	Adaptation	Other sectors Transport	• Port Vila Urban Development Project • Vanuatu Education Support Program • Vanuatu Health Sector Support • Vanuatu Skills for Economic Growth Phase IV • Vanuatu Transport Sector Support Program Phase 2 • Wan Smolbag Theatre Community Partnership
South and West Asia Regional	7,834,000	6,355,724	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Energy Water and sanitation	• Sustainable Development Investment Portfolio Phase 2
Afghanistan	3,114,920	2,527,135	Disbursed	ODA	Grant	Adaptation	Other Sectors	• Australia Afghanistan Community Resilience Scheme • Humanitarian Action in Afghanistan
Bangladesh	2,359,800	1,914,506	Disbursed	ODA	Grant	Cross-cutting	Other Sectors	• Strategic Partnership Arrangement Phase 2 with Building Resources Across Communities (BRAC)

Recipient country/ region/project/ program/activity [b]	Total Amount			Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
	Climate-specific [f, 2]							
	Domestic Currency AUD	USD	Status [c, 3]					
Pakistan	4,300,500	3,488,996	Disbursed	ODA	Grant	Cross-cutting	Agriculture Other Sectors	• Australian Assistance to Agriculture Development in Balochistan Border Areas Phase II • Pakistan Humanitarian Support
Sri Lanka	105,000	85,187	Disbursed	ODA	Grant	Adaptation	Disaster prevention and preparedness	• Sri Lanka Humanitarian Assistance
East Asia Regional	2,636,225	2,138,769	Disbursed	ODA	Grant	Cross-cutting	Agriculture Energy Other sectors Transport Water and sanitation	• Greater Mekong Water Resources Program • Grow Asia (World Economic Forum) • IFC Sustainable Hydropower in the Mekong Countries • Mekong - Australia Water Facility • Oxfam-Civil Society Engagement in Water Governance • Research for Development on Water Governance • Smart Cities Investment Design • Stocktake of South East Asia Climate Change Activities • The Private Infrastructure Development Group

CTF Table 7(b)

CTF Table 7(b)

Recipient country/ region/project/ program/activity [b]	Total Amount Climate-specific [f, 2] Domestic Currency AUD	USD	Status [c, 3]	Funding source [g, 4]	Financial instrument [g, 5]	Type of support [g, h, 6]	Sector [d, g, 7]	Additional Information [e 8]
Cambodia	6,210,380	5,038,482	Disbursed	ODA	Grant	Adaptation	Agriculture Transport	• Cambodia Agricultural Value Chain Program Phase II • Cambodia Rural Roads Improvement Project
Indonesia	9,118,815	7,398,095	Disbursed	ODA	Grant	Cross-cutting	Agriculture Cross-cutting Disaster prevention and preparedness Environment Other Sectors Water and sanitation	• Australia Indonesia Partnership for Rural Economic Development Program • Disaster Response and Preparedness in Indonesia • Governance for Growth KOMPAK • Indonesia Australia Partnership for Environmental Governance • Indonesia Infrastructure Program (KIAT)
Myanmar	157,342	127,652	Disbursed	ODA	Grant	Cross-cutting	Other sectors	• Livelihoods and Food Security Trust Fund
Philippines	149,860	121,581	Disbursed	ODA	Grant	Adaptation	Other Sectors	• Response and Recovery Assistance to the Philippines
Vietnam	3,008,940	2,441,153	Disbursed	ODA	Grant	Cross-cutting	Environment Other Sectors	• Australia - World Bank Strategic Partnership in Vietnam Phase 2 • Vietnam Climate Innovation Centre

Note: Explanation of numerical footnotes is provided in the documentation box after tables 7, 7(a) and 7(b).

Abbreviations: ODA = official development assistance, OOF = other official flows; USD = United States dollars.

b Parties should report, to the extent possible, on details contained in this table.

c Parties should explain, in their biennial reports, the methodologies used to specify the funds as disbursed and committed. Parties will provide the information for as many status categories as appropriate in the following order of priority: disbursed and committed.

d Parties may select several applicable sectors. Parties may report sectoral distribution, as applicable, under 'Other'.

e Parties should report, as appropriate, on project details and the implementing agency.

f Parties should explain in their biennial reports how they define funds as being climate-specific.

g Please specify.

h This refers to funding for activities that are cross-cutting across mitigation and adaptation.

Each Party shall provide an indication of what new and additional financial resources they have provided, and clarify how they have determined that such resources are new and additional. Please provide this information in relation to table 7(a) and (b).

Documentation Box:

1: Core/general. The Australian financial year runs from 1 July to 30 June. Therefore, the figures for 2017 are for the period 1 July 2016–30 June 2017, and for 2018 are for the period 1 July 2017–30 June 2018.

USD exchange rates are based on annual average conversion rates for the relevant financial year as published by the Australian Taxation Office: (FY2016/17: 0.7891 and FY 2017/18: 0.8113). Sources: Average rate for year ended 30 June 2017: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2017/ and Average rate for year ended 30 June 2018: https://www.ato.gov.au/Tax-professionals/TP/Financial-year-ending-30-June-2018/

Global programs refer to investments that deliver activities across multiple countries or regions.

2: Climate-specific. Australia sources its climate finance from new and additional aid budget appropriations passed by the Australian Parliament on an annual basis.
The methodology Australia employs to track climate finance expenditure is based on the Organisation for Economic Development and Cooperation (OECD) Development Assistance Committee (DAC) Rio statistical markers for climate change mitigation and adaptation.
For contributions through multilateral channels Australia counts a percentage of its core contributions according to the imputed shares calculated by the OECD DAC.
For bilateral, regional and global programs, Australia assesses each activity to determine if it has an explicit climate change objective (based on OECD DAC guidance) and whether this is a primary or secondary objective. For an explanation of this methodology see Australia's 4th Biennial Report.

3: Status. Australia only reports on funds which have been disbursed, that is transferred to partner countries/organisations.

4: Funding source

5: Financial instrument. Australia's climate finance contributions are wholly grant-based.

6: Type of support. Australia reports on all climate finance through multilateral channels as being cross-cutting.
For bilateral, regional and global programs, Australia assess each activity to determine if the support is for adaptation, mitigation or cross-cutting.
Most of Australia's country and regional programs, and its portfolio of global programs, contain a mix of mitigation and adaptation activities. Because the CTF table only allows one category to be selected, programs have been labelled as cross-cutting except where they are 100 per cent focused on either adaptation or mitigation. See Australia's 4th Biennial Report for a full explanation and more detailed breakdown of the split between adaptation, mitigation and cross-cutting.

7: Sector. Australia allocates sectors in the BR based on OECD DAC Sector Codes assigned when aid activities are established. Other sectors have been specified where Australia's climate finance is significant, for example Environmental Policy and Administrative Management categorised as 'Environment'. Other (Other Sectors) refers to additional sectors reported on under DAC guidance which are not captured by the BR sector options and where Australia's climate finance is relatively modest, for example health and education.
All funds disbursed through multilateral channels are classified as 'cross-cutting' to reflect a broad range of sectors.

8: Table 7b 'additional information' lists the names of bilateral, regional and global programs that include a climate finance component.

CTF Table 7(b)

CTF Table 8 Provision of technology development and transfer support 2016–2018 [a, b]

Recipient country and/ or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
Global	Mitigation and Adaptation	AgResults	Agriculture	Public	Public and Private	Implemented	This program is incentivising private sector action and investment through payment for results awards that promote the uptake of innovative technologies by smallholder farmers at scale. This includes a Vietnam pilot to reduce greenhouse gas emissions while increasing rice yields through improved farm management.
Papua New Guinea	Adaptation	PNG Transport Sector Support Program Phase 2	Transport	Public	Public and Private	Implemented	This program includes rehabilitation and improvement of the Alotau Provincial wharf in Milne Bay Province of Papua New Guinea.
Solomon Islands	Mitigation	Tina River Hydropower Project	Energy	Public	Public and Private	Implemented	This project is converting a major proportion of Honiara's energy supply from diesel-based to hydro, which will help the Solomon Islands Government meet its renewable energy targets.
Tonga	Mitigation	Outer Island Renewable Energy Project	Energy	Public	Public and Private	Implemented	This project involved construction of 1.25 MWp distributed solar power capacity in nine outer islands of Tonga (on and off grid) to reduce Tonga's dependence on imported fossil fuels for power generation.
Vanuatu	Adaptation	Port Vila Urban Development Project	Transport	Public	Public and Private	Implemented	This project supports the Government of Vanuatu to establish and maintain sustainable and resilient urban infrastructure in Port Vila.

Recipient country and/ or region	Targeted area	Measures and activities related to technology transfer	Sector [c]	Source of the funding for technology transfer	Activities undertaken by	Status	Additional information [d]
East Asia Regional	Mitigation and Adaptation	Research for Development on Water Governance	Energy Water and sanitation	Public	Public and Private	Implemented	Australia funds research projects in the Greater Mekong region on sustainable use of water resources including hydropower development, adaptation to climate change, river basin management and river health assessment.
South and West Asia Regional	Mitigation and Adaptation	Sustainable Development Investment Portfolio	Agriculture Cross-cutting Energy Other sectors Water and sanitation	Public	Public and Private	Implemented	This program includes demonstration and adoption of cost effective sustainable/conservation focused agriculture technologies to improve farm productivity/resource use efficiency and inform policy makers of viable adaptation options to improve food security and climate resilience.

a To be reported to the extent possible.

b The tables should include measures and activities since the last national communication or biennial report.

c Parties may report sectoral disaggregation, as appropriate.

d Additional information may include, for example, funding for technology development and transfer provided, a short description of the measure or activity and co-financing arrangements.

CTF Table 8

CTF Table 9: Provision of capacity-building support 2016–2018 a

Recipient country / region	Targeted area [d]	Program or project title	Description of program or project [b, c]
Global	Adaptation	Australian Water Partnership	This initiative provides a platform to share Australia's water experience and expertise with countries in the Indo–Pacific region across a wide range of activities, with a particular focus on climate change.
Global	Multiple Areas	International Partnership for Blue Carbon	The Partnership builds awareness, shares knowledge and accelerates practical action to protect and restore blue carbon ecosystems (mangroves, tidal marshes and seagrasses).
Global	Mitigation	Global Forest Observations Initiative	This initiative is a global partnership for coordinating the delivery of international support in forest monitoring. The Australian-led methodology component provides practical advice for designing and implementing systems that are compliant with international best practice and reporting requirements.
Asia-Pacific Regional	Mitigation	Responsible Asia Forestry and Trade	This program built the capacity of governments, businesses, and communities in the region to practice legal and sustainable forest management and trade, with a focus on timber legality verification and the application of sustainable forest management practices.
Asia-Pacific Regional	Mitigation	Asia-Pacific Rainforest Partnership	This Partnership builds connections between governments, the private sector, and civil society to promote greater action to reduce emissions from deforestation in the Asia–Pacific region.
Pacific Regional	Adaptation	Climate and Oceans Support Program in the Pacific	This program, implemented by the Australian Bureau of Meteorology, supports 14 Pacific meteorological services to monitor, analyse and communicate information about climate and oceans, including seasonal forecasts and sea level rise.
Pacific Regional	Multiple Areas	Pacific women UNFCCC negotiator training	Australia supports negotiator training for Pacific women delegates new to the climate negotiations process to enable them to engage effectively in negotiations and build an understanding of the gender dimensions of climate change. The program is a multiyear, multitiered training and travel support program to train women leaders and build the capacity of twelve Pacific Island nations' delegations to advocate for climate policies.

Recipient country / region	Targeted area [d]	Program or project title	Description of program or project [b,c]
Kiribati	Multiple Areas	Growth and Economic Management Program	This program builds skills and capacity to mainstream climate change into the Kiribati Development Plan and supports an advisor in the Office of the President to provide strategic and technical support to access and manage climate finance.
Papua New Guinea	Multiple Areas	Climate Change Portfolio Plan	Australia provided support to PNG's Climate Change Development Agency by funding a dedicated climate change advisor position and broader capacity building to help implement PNG's National Climate Compatible Development Strategy.
Tuvalu	Adaptation	Pacific Technical Assistance Mechanism	Australia funded a Climate Change Technical Advisor to build capacity of the Tuvalu Government's Climate Change and Disaster Coordination Unit to manage climate change impacts.
Vanuatu	Adaptation	Skills for Economic Growth	This initiative mainstreams climate change in vocational training, including building local skills in the design and construction of cyclone resistant buildings and tourism facilities, and climate-smart agriculture practices to improve resilience.
Indonesia	Mitigation	Australia Indonesia Partnership for Environmental Governance	This program supports Indonesia's efforts to prevent the recurrence of fires and to reduce associated emissions. Technical experts from Australia and multilateral agencies partner with the Government of Indonesia to promote sustainable land management practices, and strengthen governance and law enforcement. It also builds on a decade of Australian support for Indonesia's national forest monitoring to improve Indonesia's capacity for the MRV of greenhouse gas emissions and pilot new technology to provide information for use in demonstrating action against its Nationally Determined Contribution.
Thailand	Mitigation	Australia–Thailand cooperation on national greenhouse gas inventories	This program has successfully designed and developed Thailand's national greenhouse gas emissions inventory system (TGEIS), and is currently supporting Thailand on the sustainability of operation and development of Thailand's third Biennial Update Report (BUR).

a To be reported to the extent possible.

b Each Party included in Annex II to the Convention shall provide information, to the extent possible, on how it has provided capacity-building support that responds to the existing and emerging capacity-building needs identified by Parties not included in Annex I to the Convention in the areas of mitigation, adaptation and technology development and transfer.

c Additional information may be provided on, for example, the measure or activity and co-financing arrangements.

d 'Multiple Areas' refers to activities that are cross-cutting across mitigation and adaptation.

CTF Table 9

Appendix 2 – Additional Material

State and territory climate change policy register (current as of 1 October 2019)

Australian Capital Territory

Targets

Legislated target of net zero emissions by 30 June 2045.

Interim targets to ensure the ACT is on track to reach net zero emissions by 30 June 2045. The interim targets are based on recommendations from the ACT Climate Council. The interim targets are:

- 40 per cent below 1990 levels by 2020
- 50–60 per cent below 1990 levels by 2025
- 65–75 per cent below 1990 levels by 2030
- 90–95 per cent below 1990 levels by 2040.

Target of 100 per cent renewable electricity by 2020.

Policies

Climate change mitigation

The ACT Government released a new climate change strategy, the *ACT Climate Change Strategy 2019–2025* (Climate Change Strategy), in September 2019. The Climate Change Strategy contains actions to reduce emissions to 2025, and ensure the ACT is on the right track to reach net zero emissions by 2045.

The ACT's previous climate change strategy, *Climate Change Strategy and Action Plan* (known as 'AP2'), has been superseded by the new Climate Change Strategy.

Climate change adaptation

The 2016 *ACT Climate Change Adaptation Strategy* has been superseded by the Climate Change Strategy. Most of the actions contained in the Adaptation Strategy were completed, with remaining actions incorporated into the Climate Change Strategy, along with new actions to increase resilience.

The Climate Change Strategy is supported by *Canberra's Living Infrastructure Plan: Cooling the City* (the Plan) which was released in September 2019. The purpose of the Plan is to improve management and provision of vegetation, water and soils to help reduce climate change impact risks in Canberra, and ensure these resources continue to provide benefits to the Canberra community.

Trees and other types of living infrastructure are particularly cost effective and efficient in reducing urban heat and flash flooding, which is particularly important given the projected increase in temperatures and extreme weather events. Living infrastructure also provides a range of other environmental, economic and health benefits helping to improve liveability, biodiversity and resilience.

The Plan includes actions to increase nature in both the public and private realm. Importantly, the Plan includes a 30 per cent canopy cover (or equivalent) and 30 per cent permeable surfaces target to be achieved across urban areas by 2045.

Leading

Under the new climate change strategy and existing legislation, the ACT is the first Australian state or territory government to commit to:

- a zero emissions gas sector by 2045
- transitioning to a zero emissions bus fleet by 2040
- adopting a social cost of carbon for emissions
- meeting emission reduction targets without the purchase of offsets
- all new Government buildings being all-electric (and so zero emissions)
- all new public schools being all-electric (and so zero emissions)
- transitioning to a zero emissions government passenger vehicle fleet
- developing a pathway to zero emissions hospitals
- legislating and achieving 100% renewable electricity from 2020
- being the first jurisdiction to allow its Energy Efficiency Improvement Scheme to cover transport, insulation, and cover priority low income houses.

Energy efficiency

The Energy Efficiency Improvement Scheme requires electricity retailers to achieve energy savings in households and small-to-medium enterprises. A Priority Household Target ensures that a proportion of the savings are delivered in low income households. The Energy Efficiency Improvement Scheme is now being extended to 2030.

Renewables

The ACT government undertook a reverse auction program for large-scale wind and solar projects between 2012 and 2016. The final large scale wind farm supported by the ACT will commence operation later in 2019. From 2020 100 per cent of ACT electricity supply will be from renewable sources.

In September 2019 the ACT Government announced its intention to hold a further renewable electricity reverse auction. The auction will procure up to 250 MW of new renewables to ensure the ACT maintains its 100 per cent renewable electricity supply well into the 2020s. This will take account of anticipated population growth and fuel switching from other energy sources to electricity.

The $12 million industry-funded Renewable Energy Innovation Fund, is financing activities to support the local renewable energy innovation ecosystem.

The $25 million Next Generation Energy Storage Grants program will support the roll out of around 5,000 solar battery storage systems to 2020 in Canberra homes and businesses.

The Renewable Energy Industry Development Strategy will accelerate the development of an export-oriented, renewable energy industry in the ACT.

Transport for Canberra establishes the framework for Canberra's transport planning to 2030 to achieve mode share targets and to reduce transport emissions. This is being updated in 2019.

A draft of the ACT's new transport strategy, the Moving Canberra 2019–2045 Integrated Transport Strategy, was released in early 2019 for public consultation.

The Zero Emission Vehicles Action Plan, released in April 2018, guides the ACT's transition to zero emission vehicles. This action plan will build on the ACT's already existing financial incentives for zero emissions vehicles including zero stamp duty and 20 per cent registration discount. These incentives are the most generous in Australia.

The Zero Emissions Vehicle Action Plan is linked to the ACT's next transport and climate change strategies to ensure the ACT are well placed in the increasing global shift to zero emission vehicles. The Zero Emission Vehicles Action Plan contains a variety of actions, including a Government commitment to a zero emission vehicle fleet, new charging infrastructure, and incentives for consumers to purchase zero emission vehicles. In order to support the transition to zero emission vehicles, the Zero Emission Vehicle Action Plan commits to a range of measures, including:

- Transitioning the ACT Government fleet to zero emission vehicles (at least 50 per cent of all newly leased ACT Government fleet passenger vehicles will be zero emission vehicles by 2019–20 and all newly leased ACT Government passenger vehicles will be zero emission vehicles from 2020–21 (where fit for purpose). The ACT Government has already installed 46 charging stations for Government fleet vehicles, has 31 zero emissions vehicles in our fleet and this will increase to over 80 by mid-2020. In addition we will have 20 hydrogen vehicles join the fleet in 2020.
- Requiring all new multi-unit and mixed use developments to install electric vehicle charging infrastructure.
- Permitting zero emission vehicles to drive in transit lanes until 2023 (commenced in 2018).
- Working with local and state governments to facilitate the installation of charging stations on major routes to and from Canberra including routes to Sydney and coastal areas.
- Investigating incentives to encourage the use of electric bikes in place of cars.

Other

The ACT planning strategy 2018 establishes how the territory will develop into the future to meet the aspirations of the people and the environmental, social and economic challenges of the 21st century.

The ACT Waste Management Strategy 2011–2025 outlines the direction for the management of waste in the ACT to achieve a carbon neutral waste sector. This was updated in 2018.

New South Wales

Targets

Long-term aspiration target of net zero emissions by 2050.

Policies

The NSW Climate Change Fund supports NSW Government actions to reduce emissions and address the impacts of climate change, including:

- conserving private land to reduce the vulnerability of ecosystems to climate change
- building the capacity of land management agencies to enhance bushfire management
- supporting councils to reduce exposure to coastal hazards and other climate risks
- environmental assessment of raising Warragamba Dam wall for flood mitigation
- delivering successful on-going adaptation programs to assist our regions adapt to climate change
- delivering sustainability programs to improve our use of water, energy and land
- delivering programs to understand and plan for climate extremes of flooding and storms.

Energy efficiency

The NSW Energy Savings Scheme, an energy efficiency white certificate scheme, enhanced in 2015, could save households and businesses up to $6.2 billion on their energy bills between 2009 and 2040.

In 2017 and 2018 the NSW Government announced $192 million in funding from the Climate Change Fund for energy efficiency programs. This funding includes:

- funding for energy efficiency upgrades to help low income renters save on their energy bills
- funding for upgrades to more energy-efficient equipment for manufacturers
- funding for councils to upgrade inefficient mercury vapour street lights to highly efficient LEDs
- discounts on equipment upgrades for small business to save each business up to $1900 on their yearly bill.
- discounts for energy efficient lighting and air conditioning upgrades for all households
- discounts for up to 23,000 concession cardholders to save up to 50 per cent on the cost of upgrading old fridges and TVs to energy saving models
- energy saving upgrades for up to 16,500 public, community and Aboriginal housing clients to assist the state's most vulnerable
- investigating new energy efficiency standards for appliances, buildings and infrastructure.

The Government Resource Efficiency Policy, launched in 2014 and updated in February 2019, reduces waste and energy use and improves energy efficiency in government operations. The updated version includes strengthened energy performance requirements.

Minimum energy savings targets for all new homes built in the state under its Building Sustainability Index (BASIX) policy were increased in July 2017. These will save over 350,000 households around $1.1 billion on energy bills from 2017 to 2035.

Renewables

Unregulated feed-in tariff for small-scale renewables.

The NSW Government has set a target for the roll-out of solar panels on government buildings of 25,000 MW hours a year by 2021 and 55,000 MW hours a year by 2024.

In 2018 the NSW Government announced $170 million in funding from the Climate Change Fund to support clean energy programs for NSW. This funding enables:

- communities across the state to build local clean energy projects
- help to develop and accelerate clean energy technology, including pumped hydro, for regional communities
- Low Income Household Rebate recipients to install rooftop solar
- support smart energy storage on key government buildings
- interest-free loans to households to install battery and solar-battery systems.

Transmission Infrastructure Strategy released in November 2018 investigated future transmission needs and identified barriers to private sector investment in new energy generation and network infrastructure.

Transport

Electric and Hybrid Vehicle Plan released January 2019 as part of the Future Transport Strategy includes three priority areas: vehicle availability, charging points and customer information. Specific actions include:

- target for 10% of new NSW Government general purpose vehicles to be hybrid or electric from 2020/21
- electric bus trial in Sydney's inner west from July 2019
- co-investing in fast chargers on major regional corridors
- co-investing in charging points in commuter carparks.

The NSW ethanol mandate is designed to support the biofuels industry to grow in NSW. Under the *Biofuels Act 2007*, the mandate requires ethanol to be at least six per cent of all petrol sold by a retailer. In May 2018, the NSW Government announced $4.6 million in funding for a shared-access biofuels research and development hub. The hub will support the growth of commercially viable biofuel technology and is expected to produce over 200,000 litres of biofuel per annum.

The Future Transport Strategy, released in 2018, sets the following future directions for the NSW Government to investigate:

- encourage a shift from private car use to public transport
- promote low emission vehicles
- transition to a cost-effective, low emission energy supply, using power purchase procurement to increase renewable energy mix
- work with industry partners on new fuel efficient vehicle technologies and transition to a low emissions passenger vehicle fleet.

Sydney Metro Northwest committed to offsetting 100 per cent of GHG associated with operational electricity and in 2018 signed a power purchase agreement to build Beryl solar farm near Gulgong.

Sydney Metro City and Southwest Sustainability Strategy also commits offsetting 100 per cent of GHG associated with operational electricity and 25 per cent of electricity needs during construction. This commitment is being progressed via the procurement of electricity from a new renewable energy source.

In addition, Transport for NSW's Sustainable Design Guidelines require:

- All projects with a Capital Expenditure greater than $15 million to reduce construction related GHG emissions by a minimum 5 per cent from the project baseline GHG footprint which is established using the Carbon Estimate and Reporting Tool.
- Buildings to be designed and built to reduce energy consumption.

Other

Department of Primary Industries Climate Change Research Strategy released in 2019 includes $29 million of funding for seven actions to respond to climate and energy challenges in the primary industries sector. This funding includes:

- helping energy-intensive farms improve their efficiency
- investigating biomass for bioenergy
- investigating emissions reduction pathways for primary industries
- increasing primary industries access to carbon markets
- researching the vulnerability and adaptability of primary industries to a changing climate.

Coal Innovation NSW is continuing to support research into low emissions coal technologies.

The NSW Government has extended the Waste Less, Recycle More initiative until 2020–21.

206 contracted Emissions Reduction Fund projects.

Adaptation

The NSW Climate Change Policy Framework includes an objective to achieve net-zero emissions by 2050 and make NSW more resilient to a changing climate.

In November 2018 the NSW Government announced $30 million in new adaptation and resilience funding from the Climate Change Fund. This funding enables:

- upgrades to the NSW and ACT Regional Climate Model (NARCliM) and develop new projections
- contestable grants to support regional consideration of climate change impacts in decision-making and enhance climate resilience in NSW councils
- best-practice guides and tools to assist councils, emergency service, water resource and bushfire mangers better plan and respond
- Assessing risks to critical infrastructure due to heat, flood and bushfire.

Assessing, managing and responding to risks associated with climate change is embedded in NSW strategic planning documents including the State Infrastructure Policy, the Critical Infrastructure Resilience Strategy, the Emergency Risk Management Framework, the State Planning Regional strategic plans and the Energy Security Taskforce recommendations.

The Future Transport Strategy also includes directions for NSW to ensure the transport network is more resilient to significant weather events in an unpredictable climate.

- Identify and quantify the probabilities of significant weather events and other impacts on transport, to determine a risk profile for existing and planned infrastructure assets.
- Continue to work with the Office of Emergency Management (OEM) on State Level Emergency Risk Assessments as well as mitigation, prevention, preparedness, response and recovery activities.
- Identify the interdependencies among transport, water, energy and telecommunications infrastructure during significant weather events, to inform future asset management and emergency response.
- Develop a model to illustrate the effect of extreme weather events to inform planning and asset design.

The NSW Government has established a new coastal management framework to manage the coastal environment in an ecologically sustainable way for the social, cultural and economic well-being of the people of New South Wales. The framework commenced on 3 April 2018 and consists of new legislation, a new planning policy as well as a funding boost of $83.6 million. An expert advisory body has also been appointed, along with a coastal management manual to assist local government in planning and implementing coastal management programs. The Coastal Management Act 2016 replaces the Coastal Protection Act 1979 and establishes a new strategic framework and objectives for managing coastal issues in NSW.

Northern Territory

Targets

Target of 50 per cent renewable energy electricity consumption by 2030.

Long-term aspiration target of net zero emissions by 2050.

Policies

Energy efficiency

The Smarter Business Solutions program offers free advice and grants to NT business owners, Indigenous enterprises and not-for-profit organisations.

Funding for local government councils to install energy efficient equipment including LED street lights and energy efficient air-conditioning systems.

Renewables

One for one feed-in tariff for small-scale renewables.

The Solar Energy Transformation program, rolling out 10 MW of solar to reduce diesel consumption across 25 remote communities.

$5 million over three years for the Alice Springs Centre for Excellence for Solar Energy – the 'Intyalheme Centre for Future Energy'.

$1.5 million over three years for research and development projects

Approved power purchase agreements with renewable energy investors for a total of 45 MW of large scale solar power to be connected to the Darwin to Katherine electricity network.

Awarded Major Project status for a $20 billion solar energy export project proposed by Sun Cable. This 10 GW solar and energy storage project for construction in the Barkly region of the Northern Territory aims to generate competitively priced, dispatchable electricity for transmission via a high voltage direct current network to customers in the Northern Territory and Singapore.

Other

36 contracted Emissions Reduction Fund projects.

The Government is developing an Offsets Policy, to be finalised in late 2019

Adaptation

The Government has released a draft Climate Response Strategy for consultation. Adaption to climate change has been incorporated into the response, including: the development of adaption strategies to address risks to climate-sensitive sectors and government services and assets; embedding climate risks across government decision-making and relevant policies; and, through the communication of the risks and facilitation of adaption across the NT through the Climate Change Response website.

Queensland

Targets

Aspirational target of net zero emissions by 2050.

- Interim emissions reduction target of at least 30 per cent below 2005 levels by 2030.
- 50 per cent renewable electricity by 2030.
- One million solar rooftops or 3,000 MW of solar photovoltaics by 2020.

Policies

Renewables

The Queensland Government's *Powering Queensland Plan* represents a $1.16 billion investment to ensure Queenslanders continue to enjoy an affordable, secure and sustainable supply of electricity.

One of the key actions being implemented is the establishment of a new government owned, clean energy generator, 'CleanCo', to manage the cleaner, affordable, sustainable energy supply for Queensland.

The Queensland Government has commenced trials to deploy renewable-energy solutions in isolated communities.

Work has commenced to implement projects in Doomadgee, Mapoon, Pormpuraaw, and Bamaga.

Leveraged $20 million of ARENA funding to support the Solar 150 program.

The Renewables 400 project is a reverse auction for up to 400 MW of renewable capacity, including 100 MW of storage.

The Queensland Government launched the *Advancing Clean Energy Schools* (ACES) program, representing a $97 million investment over three years to reduce energy costs by about 20 per cent across Queensland state schools through solar and energy efficiency measures.

The Queensland Hydrogen Industry Strategy is supporting the development of a sustainable hydrogen industry for Queensland.

Energy Efficiency

The Queensland Government's *Affordable Energy Plan* will deliver $300 million in initiatives to make energy more affordable for residential and business customers.

The Queensland Government has an election commitment to implement an energy efficiency scheme, and the Department of Natural Resources, Mines and Energy is the lead agency responsible for this commitment.

The Government's ecoBiz program, delivered in a partnership with the Chamber of Commerce and Industry Queensland, supports small to medium business to reduce their bills and their environmental impact, including energy efficiency and renewable investments.

The Energy Savers program assists farmers and agribusinesses reduce energy costs by supporting the accelerated adoption of improvements in energy use. This program has recently been extended to enable energy audits for an additional 200 agribusinesses and $4 million in rebates to support the implementation of audit recommendations.

The Rural Water Use Efficiency Irrigation Futures Program provides funds to industry to promote and deliver improved water and energy use efficiency in irrigated agriculture. Between 2013 and 2017, this program invested over $8m to improve irrigation and land management practices, promote efficient irrigation equipment and the adoption of contemporary technologies.

Transport

The Queensland Electric Super Highway is the world's longest electric super highway in a single state. It is part of *The Future is Electric*, Queensland's electric vehicle strategy, and allows Queenslanders and tourists to travel from Coolangatta to Cairns and from Brisbane to Toowoomba in a low or zero emissions vehicle.

Other

The Just Transition Group was established to help create new jobs, drive economic diversification and encourage further investment.

The Communities in Transition program is part of a suite of actions to work with regional communities to transition to a clean growth economy, under the Queensland Climate Transition Strategy. This pilot project will deliver sustainable economic development roadmaps, supported by business cases for strategic investment projects on each community.

The Queensland Government is investing $1.73 million to assist islands in the Great Barrier Reef to reduce their carbon emissions under the Decarbonising the Great Barrier Reef Islands Project.

The Circular Economy Lab was an Australian-first project that facilitated innovation and collaboration across industry to develop commercial solutions to transition to a circular economy.

$8.4 million Queensland CarbonPlus Fund to support the carbon farming industry in Queensland including for capacity building services by equipping Queensland Aboriginal community participation in the carbon market industry.

Requiring Queensland Government projects of greater than $100 million to undertake a sustainability assessment.

The Queensland Government will develop an action plan to support liquid fuel users switch to sustainable, low carbon biofuels, particularly where electrification may be difficult, such as in the aviation, maritime, freight, mining and agricultural sectors.

The Queensland Government is leading Australia's bioeconomic revolution through the Advance Queensland Biofutures 10-Year Roadmap and Action Plan

In 2018 the Queensland Government signed the Below50 Global initiative to increase biofuels use.

Queensland Government has released its draft Waste Management and Resource Recovery Strategy are open for public submissions until Friday 5 April 2019.

$500 million commitment for a Land Restoration Fund to directly support Queensland based land sector carbon projects and create new jobs and opportunities in the industry.

250 registered Emissions Reduction Fund projects.

15.7 million ACCUs generated from Queensland-based carbon farming projects.

Adaptation

The Queensland Climate Adaptation Strategy outlines the resilience strategy for Queensland. This includes 18 actions across four pathways:

- People and knowledge: Build adaptive capacity in communities, develop climate science and use it as education tool, develop climate toolkit for risk assessment.
- State government: Develop Government Adaptation Action Plan, manage risks, seek consistent national policy, and incorporate sustainability objectives into infrastructure projects, monitor and review.
- Local government and regions: Support, facilitate coastal hazard adaptation planning, partner with Indigenous local councils, partner with NRM groups, and provide regionally specific tools.
- Sectors and systems: Assist stakeholders to collaborate to identify adaptation needs and to prioritise adaptation activities. Support the development and implementation of Sector Adaptation Plans and private sector adaptation actions, investigate finance and insurance options, and address cross-sectorial issues. Completed Sector Adaptation Plans include those for 'agriculture', 'built environment and infrastructure', 'tourism', 'emergency management', 'human health and wellbeing', 'biodiversity and ecosystems', and 'small and medium enterprises'. The remaining plan for 'energy, mining, manufacturing and supporting entities' is currently being finalised.

The $QCoast_{2100}$ program is supporting local coastal councils and their communities plan and prepare for storm tide, coastal erosion and rising sea levels resulting from climate change.

The Queensland Climate Resilient Councils program is available to all local governments to strengthen internal council decision-making processes to respond to climate change.

Queensland Climate Ready (QCR) is a two-year program to strengthen institutional climate risk management within the Queensland Government. The program aims for a whole-of-government climate risk management approach to policies and processes, investments, services and actions

South Australia

Targets

By 31 December 2050, reduce greenhouse gas emissions within the State by at least 60 per cent to an amount that is equal to or less than 40 per cent of 1990 levels (*Climate Change and Greenhouse Emissions Reduction Act 2007*).

The South Australian Government will aim towards net zero emissions by 2050.

South Australia's Waste Strategy (2015–2020) includes targets to: divert 70 per cent of municipal solid waste from landfill by 2020; divert 80 per cent of commercial and industrial waste from landfill by 2020; and divert 90 per cent of construction and demolition waste from landfill by 2020.

The South Australian Government is aspiring to reach net 100 per cent renewables in the 2030s.

Policies

Energy efficiency

The SA Retailer Energy Efficiency Scheme (REES) requires energy retailers to help households and businesses save on energy use and costs, and lower their greenhouse gas emissions by offering free or discounted energy efficiency activities. This scheme is being reviewed in 2019.

The Government offers a phone, email and drop-in Energy Advisory Service to support energy efficiency questions from households and businesses.

The Energy Partners Program works with around 100 organisations across the state, with projects focused on improving energy education and information to help South Australians manage their energy use and costs.

Renewable energy and storage infrastructure

The Government's Energy Policy includes the following major initiatives:

- Honouring all commitments to projects under the $150 million Renewable Technology Fund which has supported 21 projects (including the Hornsdale Power Reserve 100 MW battery) with grant or loan financing.
- Establishing a $50 million Grid Scale Storage Fund to develop new storage and technologies capable of supporting renewable energy in South Australia.
- Investing $100 million to support the take-up of storage for home-based solar photovoltaic systems through the Home Battery Scheme.
- Partnering with Tesla in a pilot project to establish a Virtual Power Plant, with a current focus on the installation of home energy systems on 1,100 public housing. Subject to the trial's outcomes, there is potential to roll the program out to a further 49,000 properties.

- Creating a $200 million Interconnection Fund to provide South Australians with access to cheaper power and a more reliable energy supply by fast tracking the development of an interconnector between South Australia and New South Wales.
- 30 million Demand Management Trials program to support integration of distributed generation, demand response and demand aggregation assets to increase grid efficiency and incentivise consumers to manage their own electricity demand.
- The Government has a Bioenergy Roadmap, developed in 2015, and is currently supporting projects for development of a bioenergy industry in South Australia.

The government has a contract for the supply of 100 per cent of the government's energy supply from renewable sources in 2019. The government will soon commence an open market tender process for the longer-term supply of the government's electricity needs from 2020.

South Australia's Hydrogen Economy:

- South Australia is also a key participant in Australia's development of a National Hydrogen Strategy.
- In mid-2017, the South Australian Government worked with industry to develop a Hydrogen Roadmap for potential investors and help guide the development of South Australia's hydrogen economy.
- Subsequently, the SA Government has committed to co-invest in four green hydrogen projects: Neoen Australia's Hydrogen Superhub, AGIG's Hydrogen Park of SA, H2U Green Hydrogen and Ammonia Production facility, and an electrolyser/fuel cell at UniSA's Mawson Lakes microgrid project.
- In September 2019, the South Australian Government released its Hydrogen Action Plan including the commitment of over $1 million towards a landmark study to identify optimal locations for renewable hydrogen production and export infrastructure.

SA Water is reducing emissions and electricity costs through a program of complementary initiatives that includes demand management, and investing in their own generation and storage capacity which will see up to 154 MW of solar PV and 34 MWh of energy storage installed across around 40 operational water network sites—helping move towards their goal of a zero cost energy future.

Transport

Provided funding support for strategic deployment of Electric Vehicle charging infrastructure in the Adelaide CBD, Tonsley Innovation District and major public hospital car parks.

Established and exceeded a target for 30 per cent Low Emission Vehicles in the Government's own passenger and light commercial vehicle fleet by 2019. In April 2019, low Emission Vehicles comprised 44.2 per cent of the fleet of approximately 6,800 vehicles, with approximately 20 per cent being Hybrid Electric vehicles.

Funded the manufacture of two full battery electric buses by Precision Buses based in northern Adelaide for use in the Adelaide metropolitan bus fleet.

Supported Phase 1 and 2 of the ARENA Regional EV Adoption Program *Charge Together* delivered by EVenergi and partners. Phase 1 explored the market opportunity for electric vehicles and assessed their potential impact on the electricity grid in South Australia. Phase 2 seeks to drive fleet uptake of EVs in SA, ACT and NSW.

The Future Mobility Lab Fund is supporting projects for the development and trial of autonomous zero emissions vehicle technologies.

Supported a range of activities to enable members of public to gain first-hand experiences of electric vehicles including Green Drive Days with AEVA, share car use with GoGet, and hire car services with myCar.

The Government is currently developing a new South Australian Electric Vehicle Strategy for release in early 2020. The scope includes full battery electric, hydrogen fuel cell and hybrid vehicles

Adaptation

2 million has been committed over four years for a *Greener Neighbourhoods* initiative, which will provide funding to local councils to keep metropolitan Adelaide streets green and cool, and help to reduce the urban heat island effect.

The creation of Green Adelaide will provide a strong focus on metropolitan Adelaide's environment and its people. It will drive an agenda to transform Adelaide into a cool, green and climate resilient city by focusing on priority areas such as water sensitive urban design, urban greening and nature education. Partnerships with state and local government, industry, environmental non-government organisations and the community will help to achieve the objectives of Green Adelaide.

All 12 State Government regions in South Australia have produced regional adaptation plans, identifying the impacts and issues that will affect their own part of South Australia. Currently, all regions are looking to progress and implement their priority actions from their adaptation plans to reduce regional vulnerability.

Other

The Premier's Climate Change Council is developing an across-government agency Climate Change Strategy to reduce net emissions and help South Australians adapt to a changing climate.

The Premier's Climate Change Council is developing a Blue Carbon Strategy for South Australia. The strategy will position South Australia to lead further initiatives on policy and carbon crediting mechanisms, guide programs for scientific research and undertake projects that demonstrate feasibility, costs and multiple co-benefits.

$52.4 million *Securing the future of our coastline* package of coast protection initiatives, funded over four years commencing 2019–20, will increase resilience across the state's coastline and adapt to rising sea levels, through the addition of sand from an external source and completion of the sand recycling pipeline to better manage Adelaide's beaches, and coast protection funding for regional areas.

$5.2 million in 2018 for implementation of the Government's New Life for our Coastal Environment commitment, which focuses on the restoration of the metropolitan coastline, restoring seagrasses and reefs and managing runoff, as well as research and development.

Progressing carbon farming initiatives in South Australia.

Established South Australia's first biodiverse carbon offset project on national park under the Emissions Reduction Fund.

Implementation of the *Carbon Neutral Adelaide* initiative where aligned with State Government priorities.

South Australia's Waste Strategy outlines the state's objectives, priorities and targets for waste management and resource recovery. It is renewed every five years and a new strategy is being developed for 2020–25. South Australia is also developing a Food Waste Strategy to divert more organic material from landfill where it generates GHG (methane) emissions.

Climate change has been considered an emerging risk in the State Emergency Management Committee Strategic Plan.

Under the Planning, Design and Infrastructure Act 2016, the South Australian Government is reforming the state's planning system, which provides opportunities to integrate consideration of climate change in planning for design quality, natural hazards, energy and transport infrastructure, and the adaptive reuse of buildings, sites and places.

The Department for Planning, Transport and Infrastructure is taking a step change reflective of performance based contracting by improving its Master Specification, focused on sustainable outcomes and alignment with national practices, including greater integration of climate change considerations.

Tasmania

Targets

Legislated emissions reduction target of 60 per cent below 1990 levels by 2050.

Commitment to amend the legislated target to zero net emissions by 2050.

Policies

Energy efficiency

Extended the No Interest Loans Scheme to assist low income Tasmanians to purchase energy efficient products.

$40 million Energy Efficiency Loan Scheme provided residential and small business customers interest-free loans to purchase energy efficient products.

$750,000 On-farm Energy Audit and Capital Grant Program provided funding for Tasmanian farmers to conduct energy audits and purchase new energy efficient capital infrastructure.

$850,000 Power$mart Homes energy efficiency program to help low income Tasmanian households save money on their power bills, stay warm in winter, and reduce their greenhouse gas emissions.

$250,000 energy efficiency audit program for small- and medium-sized businesses and Tasmanian Government agencies to identify energy savings opportunities.

Since 2014, the Tasmanian Government has supported DairyTas to deliver the Fert$mart Program to Tasmanian dairy farms. The Program assists farmers to reduce fertiliser emissions and costs and improve irrigation practices. Over the past two years, the Tasmanian Government has provided funding to farmers for practical on-farm infrastructure works to implement their Fert$mart plans. The Government is also developing an online tool to help farmers self-audit their energy requirements and reduce emissions.

Tasmania's Emissions Pathway Review (to 2050) Models long-term emissions trajectories across all sectors of the economy and opportunities to reduce emissions. Final report for project (not publicly available) identifies a suite of emissions abatement opportunities across all sectors that are consistent with current Tasmanian and national priorities.

Renewables

Regulated feed-in tariff for small-scale renewables.

Tasmania will invest around $1 billion in maintaining and refurbishing the State's existing hydropower assets over the next ten years.

In August 2017, the Tasmanian Government committed to making Tasmania renewable energy self-sufficient by 2022. This includes a target of an additional 1,000 GW hours of additional renewable energy generation.

Transport

Tasmanian Government commitment under Climate Action 21: Tasmania's Climate Change Action Plan 2017–2021 (Climate Action 21) to support the uptake of electric vehicles in the State.

Tasmanian Government continues to facilitate the cross-sectoral Electric Vehicle Working Group to develop a coordinated approach to support the uptake of electric vehicles in Tasmania.

By mid-2020, the Tasmanian Government's Electric Vehicle ChargeSmart Grants will deliver a convenient public charging network for local residents and visitors who wish to tour the State using electric vehicles.

The Tasmanian Government has sponsored a number of community electric vehicle try and drive events in Tasmania, and is also planning an autonomous electric bus demonstration in Hobart.

The Tasmanian Government's Smarter Fleets Program aims to reduce vehicle fleet greenhouse gas emissions and fuel costs by providing tailored guidance and support to fleet managers.

Under Climate Action 21 the Smarter Fleets Program has been extended to include Tasmanian Government agency fleets, local government fleets and heavy vehicle fleets in Tasmania.

The Smarter Fleets Program is supporting local government and Tasmanian Government agencies to be electric vehicle ready as uptake increases and more models become available.

Other

Conducting feasibility studies to assess the viability of the Marinus Link second Bass Strait interconnector and Battery of the Nation pumped hydro projects to improve the reliability and security of the National Electricity Market.

Continued Aurora Energy's Your Energy support program to provide assistance to low income residential customers.

Established the Energy Security Taskforce to undertake an independent energy security risk assessment for Tasmania, including the potential impact of climate change on energy security and supply. The Taskforce delivered its final report in August 2017 with recommendations for further renewable energy development in Tasmania.

Eleven Tasmanian-based Emissions Reduction Fund projects.

Under Climate Action 21, the Business Resource Efficiency Program is helping small to medium-sized businesses reduce their emissions by diverting waste from landfill, identify and implement circular economy opportunities, build skills and capacity, and drive productivity gains. Eleven businesses from a range of sectors are participating in the program. Waste audits have been completed for each business and participants are currently working in action learning sets to develop and implement resource

efficiency projects. An end-of-program forum is due to be held in December 2019, and the program learnings, case studies, information and educational resources will be published on the TCCO website in mid-2020.

Adaptation

A priority under Climate Action 21 is to build climate resilience to enhance the State's capacity to withstand and recover from extreme weather events and better understand and manage the risks of a changing climate.

Under Climate Action 21, the Tasmanian Government is working with coastal managers to identify and manage coastal hazards for existing settlements and values.

Over 40 health clinicians, policymakers and climate change and health researchers from around Australia attended a Tasmanian Climate Change and Health Roundtable in April 2019. Participants identified and prioritised policies, programs and research to manage the risks that a changing climate poses to the health of Tasmanians.

The Tasmanian Government continues to provide information on climate change risks and opportunities to support agricultural decision-making under the Enterprise Suitability Mapping Project.

A Tasmanian Government review of climate change research gaps and opportunities identified a number of key research priorities including: water infrastructure; coincident extreme events; downscaled projections; biosecurity and invasive pests; built, cultural and natural values; health; marine environment; and tailored and accessible information to support decision making based on future climate projections.

Under Climate Action 21, the Tasmanian Government has also examined the impacts of climate change on future bushfire risk in the Tasmanian Wilderness World Heritage Area.

The climate-related risk and liabilities project aims to increase understanding and awareness of climate-related risk and liability for Tasmanian Government agencies.

The Tasmanian Government's Climate Resilient Councils project is assisting councils to improve understanding and management of their climate-related risks when making strategic and financial decisions. Participating councils have received a report assessing how climate change is considered by their council, and suggesting opportunities for further consideration of climate-related risk in council decision making. The next phase of the project will include practical, capacity-building support to councils in relation to climate change governance.

Victoria

Targets

Legislated target of net zero emissions by 2050 with five yearly interim targets to keep Victoria on track to meet this target.

Target to reduce emissions by 15 to 20 per cent below 2005 levels by 2020.

Target to reduce emissions from government operations by 30 per cent below 2015 levels by 2020.

Legislated renewable energy generation targets of 25 per cent by 2020 and 40 per cent by 2025, and an election commitment to expand these targets through a new target of 50 per cent by 2030.

Legislated annual energy efficiency targets, set to 2020.

Policies

Climate Change

The *Climate Change Act 2017* (the Act) provides Victoria with a world-leading legislative foundation to manage climate change risks, maximise the opportunities that arise from decisive action, and drive the transition to a climate resilient community and economy with net zero emissions by 2050.

The Act:

- establishes a long-term target of net zero emissions by 2050
- requires five yearly interim targets, to keep Victoria on track to meet this long-term target
- requires the government to develop a Climate Change Strategy every five years, which will set out how Victoria will meet its targets and adapt to the impacts of climate change (from 2020)
- requires Adaptation Action Plans for key systems that are either vulnerable to the impacts of climate change or essential to ensure Victoria is prepared (from 2021)
- introduces a new set of policy objectives and an updated set of guiding principles to embed climate change in government decision making
- establishes a pledging model to reduce emissions from government's own operations and from across the economy (from 2020)
- establishes a system of periodic reporting to provide transparency, accountability and ensure the community remains informed.

Climate Change Strategy

The Act requires the government to prepare a five yearly Climate Change Strategy to coincide with the interim target periods. The first strategy must be prepared by 31 October 2020. The Strategy must include a statement of priorities related to adaptation, emissions reduction and transition for the period, an adaptation component and an emissions reduction component. The emissions reduction pledges required under the Act must be included in the Strategy, and the Strategy must be publicly consulted on for at least 28 days.

Long-term and interim emissions targets:

- The Act sets a long-term target of net zero greenhouse gas emissions by 2050. The Premier and the Minister for Energy, Environment and Climate Change will be responsible for ensuring this target is met.
- The Premier and the Minister for Energy, Environment and Climate Change must set five yearly interim targets to keep Victoria on track to meeting the long-term target. Each interim target must be more ambitious than the last, tabled in Parliament and published online.
- Setting of interim targets must be informed by independent advice. In late March an Independent Expert Panel provided its final advice on targets for 2021–2025 and 2026–2030 to the Minister for Energy, Environment and Climate Change. This advice was tabled in Parliament on 6 June 2019 and will be considered by the Minister and Premier in the setting of targets and emissions reduction pledges.
- The Act requires the first two interim targets be determined on or before 31 March 2020.

Embedding climate change in Government decision-making

Section 20 of the *Climate Change Act 2017* places an obligation on the Victorian Government to ensure it is taking account of climate change in its decisions, policies, programs and processes. Examples of this consideration include:

- Greening Melbourne's Fishermans Bend—a 480-hectare inner-city redevelopment to include Australia's largest urban renewal 'Green Star – Communities' project (4 Star) aiming for zero net emissions by 2050 and 80 per cent of all trips made by sustainable transport.
- The Level Crossing Removal Program—a coordinated program to remove 50 rail crossings across metropolitan Melbourne by 2022, with construction projects to reduce greenhouse gas emissions and minimise use of potable water.
- Victoria's Social Procurement Framework – aims to ensure Government value-for-money purchasing considerations encompass opportunities to deliver social and sustainable outcomes that benefit the Victorian community, including reducing emissions and encouraging more climate-resilient infrastructure.

Emissions Reduction Pledges

The Act establishes emissions reduction pledges as the primary mechanism to meet the interim targets:

- A whole-of-government operational pledge that relates to emissions arising from government operations and activities (e.g. building energy use, waste and vehicle fleet).
- Sector pledges by nominated Ministers, which set out measures to reduce emissions from Victoria's energy, transport, agriculture, waste, industrial process and product use, and Land Use Land Use Change and Forestry (LULUCF) sectors.
- Local Government Pledges that provide a voluntary mechanism for local governments to pledge to reduce emissions they have caused or otherwise influenced.

Pledges will be made for five yearly periods, coinciding with the interim targets periods (beginning 2021–2025). Pledges will be determined by August 2020 and included in the Climate Change Strategy.

TAKE2

Victoria's voluntary TAKE2 pledge program is one of the most comprehensive climate change pledging programs in the world. TAKE2 allows local governments, businesses, community groups and individuals to make voluntary commitments to reduce their greenhouse gas emissions.

Adaptation Action Plans

The Act requires Adaptation Action Plans for seven core systems: built environment, education and training, health and human services, natural environment, primary production, transport and the water cycle.

A Pilot Adaptation Action Plan has been developed for the water cycle system, containing 20 key adaptation actions for implementation by 2020. Pilot Adaptation Action Plan is under development for the health and human service system.

The first statutory Adaptation Action Plans for the seven systems are due in 2021.

Climate Change Adaptation

Victoria's Climate Change Adaptation Plan 2017–2020 (the Adaptation Plan) sets out the Victorian Government's strategic priorities, measures and responses for adaptation in the state to 2020. Under the Plan the Government will support adaptation and coordinate action on different scales (local, regional and sectoral). Key actions include:

- New high-resolution climate change projections for Victoria (scale: 5km) and a suite of guidance material due for release in late 2019.
- A report on Victoria's economic vulnerability to extreme heat that factors in future climate change, published in November 2018.
- Capacity building across the public service on best practice climate change science communication, including release of a literature review into best practice climate change communication in June 2019.
- A desktop assessment of adaptation governance in Victoria's 79 local governments to support a community of practice and peer-to-peer learning.
- Support for the Municipal Association of Victoria to develop climate change adaptation training for Councillors.
- A $1 million Community Climate Change Adaptation Grants Program to help build resilience to climate change impacts through community-driven adaptation actions that have been identified as priorities in Victoria's regions. Successful applicants were announced in September 2019.
- Independent analysis of the land use planning and building systems to improve the management of natural hazards, and
- A leading practice Monitoring, Evaluation, Reporting and Improvement Framework for Climate Change Adaptation in Victoria.

Reporting

The Act requires the publication of annual reports on Victoria's greenhouse gas emissions, which will monitor the state's progress in reducing emissions. Victoria's first *Victorian Greenhouse Gas Emissions Report* was released in October 2018. The second report is under development and must be prepared by 31 October 2019. Victorian emissions reports must include an overview of the state's greenhouse gas emissions, and the extent to which these emissions have changed compared with 2005 levels.

www.climatechange.vic.gov.au/information-and-resources/greenhouse-gas-emissions-in-victoria

The Act also required a first Climate Science Report, due to be finalised in October 2019, and updated every five years. The Climate Science Report must set out a synthesis of the best practicably available climate change science and its implications for Victoria and its regions; and outline data on observed changes in climate in Victoria.

Energy efficiency

The Greener Government Buildings program improves the energy efficiency of existing government buildings and infrastructure operations to reduce operating costs and greenhouse gas (GHG) emissions. Energy is saved through a combination of:

- lighting upgrades (e.g. LED)
- heating, ventilation and cooling upgrades (HVAC)

- solar panels, and
- building automation and controls.

Current projects include National Gallery of Victoria, Boxhill Institute, solar and lighting at primary and secondary schools and rooftop solar projects across various health facilities.

Since its establishment in 2009, Greener Government Buildings has facilitated $188 million in energy efficiency upgrades and renewables across 30 projects. Over 15 years, these projects are estimated to achieve cost savings of $388 million, resulting in a positive net present value of $100 million and abate 686,000 tonnes of GHG per year. The 2017 Energy Efficiency and Productivity Strategy provided $55 million for new and expanded programs, including:

- Victorian Energy Upgrades program (formerly the Victorian Energy Efficiency Target scheme)—the largest energy efficiency certificate program in Australia ($8.1 million funding 2016–20).
  - In 2017, 55,000 households and 20,000 business premises undertook energy efficiency upgrades through the program. On average, they saved $200 and $4,500, respectively, in 2018.
  - In 2017, the Victorian Energy Upgrades program introduced 'custom upgrades', providing more flexible options to access incentives for businesses with high energy use and complex upgrades.
  - In 2018, the Victorian Energy Efficiency Target Regulations were remade, with updates that will enable the scheme to expand and provide easier access to energy efficiency.
  - Targets for the 2020–2025 period are under development and will be set by 31 May 2020.
- Supporting home upgrades for Victorians most in need—under the $17 million Home Energy Assist package of programs, 1,610 low income and vulnerable householders have been supported to improve the energy efficiency of their home through appliance upgrades and household retrofits.
- Residential Efficiency Scorecard ($5.7 million over four years) for the Scorecard to provide Victorians with practical information on how to improve the energy, hot weather performance and comfort of homes and reduce household energy bills. The Scorecard provides a reliable and comparable star rating for a home and offers advice on upgrade options. As at August 2019, 47 assessors were accredited by the Scorecard program and over 2,480 assessments had been completed.
- Toward Zero Emissions Homes ($8.9 million over four years) projects:
  - Beyond 6 Star—working with other jurisdictions on the national Trajectory for Low Energy Buildings to investigate options for improving the energy efficiency regulations for new homes in 2022. Zero Carbon Homes—piloting the development and marketing of Zero Net Carbon homes in Victoria in collaboration with three Volume Home Builders.
  - As Built Compliance—working with the Victorian Building Authority to audit 2,500 homes under construction to collect data on how new homes are meeting minimum energy efficiency requirements.67 per cent of audits completed as of August 2019.
- Victorian Energy Saver Website—in addition to information on major household programs, the website provides a business gateway with tips on saving energy and information on energy retail offers, discount energy saving products, and access to grants, training and support. See: www.victorianenergysaver.vic.gov.au/.
- Environmental Upgrade Finance (EUF, formerly Environmental Upgrade Agreements)

- All Victorian local governments can offer EUF to existing building owners. Businesses borrow money through an approved lender to pay for environmental upgrades to their building such as solar panels, double-glazing and energy efficient lighting. Their local council then collects repayments through the rates system and passes them on to the lender.

Renewable energy

Victorian Renewable Energy Targets:

- In June 2016, the Victorian Government announced Victorian Renewable Energy Targets for generation of 25 per cent by 2020 and 40 per cent by 2025 (VRET). VRET will drive investment of between 3,400 MW and 5,400 MW of new renewable energy capacity.
- These targets are legislated under the *Renewable Energy (Jobs and Investment) Act 2017* (Victoria).
- The new capacity brought forward under VRET will support capital expenditure of up to $7.2 billion in renewable energy projects and create up to 10,000 jobs.
- The Victorian Government is committed to increasing VRET to 50 per cent by 2030.

The Victorian Renewable Energy Action Plan invests $146 million to support sector growth, empower communities and customers, and modernise the energy system. Initiatives include:

- Renewable Certificate Purchasing Initiative (RCPI)
  - The Department of Environment, Land, Water and Planning is procuring renewable energy certificates (established by the Commonwealth Renewable Energy Target scheme) directly from new Victorian projects. This provides the necessary revenue certainty for project developers to underwrite their projects.
  - In July 2016, two wind farms were awarded supply agreements following a competitive tender process: the 31 MW Kiata wind farm and the 132 MW Mt Gellibrand wind farm. Both wind farms are operational and exporting electricity to the grid.
  - In March 2017 the Government released a second competitive tender under the RCPI, specifically targeting new large-scale solar projects to power Victoria's tram fleet. The Solar Trams initiative will result in a reduction of more than 80,000 tonnes of greenhouse gas emissions every year.
  - The RCPI has brought forward around $666 million of capital investment and over 350 MW of capacity in new wind and solar farms, creating hundreds of direct construction jobs and promoting economic development in regional Victoria.
- Victorian Renewable Energy Auction Scheme (VREAS) will support achievement of the Victorian Renewable Energy Targets (VRET).
  - The VRET 2017 Reverse Auction (the auction) was the first auction under the VREAS and offers 15-year support agreements for new renewable energy generation projects.
  - The first VRET auction in February 2018 received 15 bids totaling 3,500 MW. The auction was forecast to deliver up to 650 MW of new renewable energy capacity but in fact delivered 928 MW of renewable energy—almost 45 per cent more power than originally anticipated—across three new wind farms and three new solar farms in regional Victoria.
  - The auction, along with other market-led renewable energy projects under construction, will put Victoria on a trajectory to meeting the 2020 VRET target.

- Energy Storage Initiative seeks to bring forward complex, 'first of a kind' projects that will have long term benefits. It has deployed energy storage technology in western Victoria.
  - The initiative invested $25 million in two battery projects, with funding matched by the Australian Renewable Energy Agency.
  - Edify Energy constructed a 25 MW/50 MWh battery at the Gannawarra Solar Farm (Kerang) to store energy produced onsite.
  - Spotless Sustainability Services provided a 30 MW/30 MWh battery system connected at Warrenheip near Ballarat, which will deliver crucial power supply, frequency control and related back-up services to maintain stability in the network for western Victoria.
- Bulgana Green Power Hub—a 15-year support agreement with Neoen Australia will deliver the Bulgana Green Power Hub (BGPH). Construction commenced in May 2018. The BGPH represents a $450 million investment in a 194 MW wind farm and 20 MW/34 MWh onsite battery storage, expected to deliver up 2 per cent progress towards VRET.
- $10 million Microgrid Demonstration Program—the Victorian Government is investing in a series of commercial ready, smart, microgrid demonstration projects across Victoria.
- New Energy Jobs Fund (NEJF)—$20 million has been provided through three annual funding rounds, designed to create new jobs and growth in the uptake of renewable energy generation, reduce greenhouse gas emissions, drive innovation in new energy technologies and assist community groups to develop renewable energy products.
  - Round One secured 24 projects, spending $5.8 million on 18 community and six industry development grants.
  - Round Two secured 20 projects, spending $5.9 million on 15 community and five industry development grants.
  - Round Three secured seven projects, spending $1.46 million on five community and two industry development grants.
  - A Renewable Communities Program round was run, securing nine projects and spending $1.14 million.
- Victorian Hydrogen Investment Program—$2 million to ensure Victoria captures the benefits of a green hydrogen economy. Three streams: market testing, industry development and investment program. The Program is currently accepting submissions to understand the extent of market interest and opportunity for hydrogen.
- Centre for New Energy Technologies (C4NET)—an independent collaborative partnership, growing the new energy technologies sector with a focus on improving access to, and use of, energy data. C4NET brings together government, educational institutions and industry in collaborative initiatives to help ensure a flexible, resilient and modern energy ecosystem in Victoria. The Victorian Government provided $5.36 million in seed funding over four years to establish the Centre.
- Energy Data Hub Concept Study – $1.85 million for a study into an energy data hub, or centralised energy data access system. A hub could empower Victorians with consent to securely and easily share their energy smart meter data with third parties offering energy solutions. Better access to energy data will create energy-wise consumers, increase system efficiency and drive innovation in the renewable energy sector. This aligns with work undertaken by the Australian Government to implement the Consumer Data Right in energy.

The Solar Homes program:

- Announced in August 2018, the Solar Homes program is incentivising the installation of solar panels, solar hot water and solar battery systems on 770,000 homes over ten years. Households are able to access one type of rebate under the Solar Homes program. The Solar Homes program is helping Victorians to take control of their energy bills, tackle climate change and provide a cleaner, better future for all.
- In the first year of the Solar Homes program (2018–19), over 33,000 households embraced the program offering and installed solar panels and solar hot water systems.
- The program is helping eligible Victorian homeowners and rental properties take charge of their power bills by providing a rebate of up to $2,225 for solar panel systems. To further reduce installation costs, householders can apply for an interest-free loan, for an amount equivalent to their rebate amount. The loan is required to be repaid over four years.
- Solar Victoria is also piloting a battery rebate scheme to help identify demand and battery usage in Victoria. In 2019–20, 1,000 rebates of up to $4,838 will be available for solar battery systems. Solar Victoria is also providing a rebate of up to $1,000 on solar hot water systems.
- The Solar Homes program is expected to generate an eighth of Victoria's 40 per cent target for renewable energy by 2025. Once fully rolled out, the program will cut Victoria's emissions by almost 4 Mt.

Water

Through the state-wide plan *Water for Victoria* the Victorian Government is committed to:

- a target of net-zero emissions in the water sector by 2050 (Action 2.1)
- understanding and applying climate science to water management (Action 2.2)
- leading climate change adaptation across Victoria's water sector (Action 2.3).

Achieve net zero emissions in the water sector:

- The water sector is responsible for the one quarter of the Victorian Government's emissions. In collaboration with the Department, Victoria's water corporations have pledged to reduce their emissions by 363,975 tonnes of carbon dioxide equivalent per year by 1 July 2025. This represents a 42 per cent reduction (from an aggregated baseline calculated from 2011–2016 levels). These pledges have been formalised in a *Statement of obligations (Emissions reduction)*.

Zero Emissions Water (ZEW) Program

- Thirteen Victorian water corporations have partnered together to create a new organisation Zero Emissions Water (ZEW). On behalf of the thirteen corporations, ZEW will purchase clean energy comprising 20 to 50 per cent of their total energy needs from the Kiamal Solar Farm in north-west Victoria. The innovative venture is the first of its kind for Australia's water sector and puts the sector on track to meet its ambitious targets for renewable energy generation, and to reduce greenhouse gas emissions by 42 per cent by 2025, and net zero by 2050.
- Understand and apply climate science to water management.

- This initiative is providing investment in research which will enable communities and industry to make informed, science-based adaptation decisions, reducing the overall risk and cost associated with climate change adaptation.
- The research includes modelling and development of tools to assess the impacts of climate change on catchment hydrology, particularly rainfall, evaporation and streamflow. This information will help water corporations, environmental water managers and adaptation decision makers to make better informed decisions and investments, and improve advice they provide to the community.

Lead climate change adaptation across Victoria's water system

- Under the *Climate Change Act 2017*, an Adaptation Action Plan will be prepared every five years in the water sector.
- The Victorian Government committed to delivering the *Pilot Water Sector Climate Change Adaptation Action Plan (WSAAP)* in Victoria's *Climate Change Adaptation Plan 2017–2020*. The pilot plan is strengthening and driving adaptation planning and action in the water sector and will inform the delivery of the first legislated water sector Adaptation Action Plan due in 2021. The WSAAP addresses three objectives from Victoria's *Climate Change Act 2017:*
  - build the resilience of the State's infrastructure, built environment and communities through effective adaptation and disaster preparedness action
  - manage the State's natural resources, ecosystems and biodiversity to promote their resilience, and
  - support vulnerable communities and promote social justice and intergenerational equity.

Biodiversity

'Protecting Victoria's Environment – Biodiversity 2037' is the Victorian Government's ambitious plan to stop the decline of biodiversity and achieve overall biodiversity improvement over the next 20 years. It sets out the Government's long-term approach to protecting biodiversity and managing growing pressures on the environment caused by factors such as climate change and population growth. It also acknowledges the importance of a healthy environment to better managing the impacts of climate change, through sequestration and 'buffering' the impacts of extreme events. More information: www.environment.vic.gov.au/biodiversity/biodiversity-plan.

Health

Victorian Public Health and Wellbeing Plan 2015–2019. The *Public Health and Wellbeing Act* (2008) requires the Minister for Health to prepare a State public health and wellbeing plan every four years (since September 2011). The plan identifies platforms to deliver health benefits for all Victorians including healthy and sustainable environments. For details:

www2.health.vic.gov.au/about/health-strategies/public-health-wellbeing-plan.

One of Victoria's energy efficiency retrofit programs, 'Healthy Homes', is delivering upgrades to householders with complex health conditions and collecting data on how thermal performance can improve health outcomes.

Built Environment Infrastructure

Plan Melbourne (the Plan) is Melbourne's metropolitan planning strategy, integrating long-term land use, infrastructure and transport planning to meet the city's future environmental, population, housing and employment needs. The Plan incorporates several directions addressing climate change and sustainability, including:

- improve energy, water and waste performance of buildings
- facilitate the uptake of renewable energy technologies
- reduce the likelihood and consequences of natural hazard events and adapt to climate change
- integrate urban development and water cycle management to support a resilient and liveable city
- make Melbourne cooler and greener, and
- protect and restore natural habitats.

Transport

Since November 2018, Victoria's entire tram network has been powered by electricity generated by solar energy. In addition, the Victorian Government is:

- Partnering with industry to deliver seven ultra-fast electric vehicle charging stations at key sites throughout Victoria, with the first two sites at Euroa and Barnawartha North (near Wodonga) now open for operation and the remaining sites to be progressively operational during 2019.
- Investing in and enhancing public transport, with significant infrastructure programs including the Melbourne Metro Tunnel, Melbourne Airport Rail Project and Suburban Rail Loop, as well as service and capacity improvements through investment in new trains, trams and buses.
- Introducing 50 new Victorian-built hybrid buses into its public bus fleet.
- Supporting walking and cycling through Active Transport Victoria and implementing the Cycling Strategy 2016.
- Supporting innovation in new technology, including funding to support a commercial electric vehicle manufacturing facility.

Western Australia

Target

State Government commitment to working with all sectors of the economy to achieve net zero greenhouse gas emissions target by 2050

Policies

State-wide Climate Change Policy under development

In 2018, the Minister for Environment, Hon Stephen Dawson MLC, announced the Government will develop a new State Climate Policy.

Public consultation commenced on 4 September 2019 with the release of the *Climate change in Western Australia – Issues paper.* Consultation closes 29 November 2019. The new policy will be completed in 2020.

Greenhouse Gas Emissions Policy for Western Australia

The policy is designed to guide Government decision making for major projects that are assessed by the Environmental Protection Authority.

Renewables

- Renewable Energy Buyback Scheme for residents, schools and non-profit organisations.
- The Whole of System Plan being developed under Energy Transformation Strategy will encompass a vision of the South West Interconnected System of the future, including opportunities to respond to increasing penetrations of renewable energy.
- Australia's first ever industrial renewable energy microgrid at the Peel Business Park in Nambeelup. The microgrid will use a solar farm and battery storage with electricity supplemented from the Western Power grid when required, to power the 120-hectare lot within the Park.
- Renewable energy micro grid and battery systems—Western Power is installing batteries for network support, including in Perenjori and one planned for Kalbarri. Western Power, in conjunction with Synergy, delivered a community-scale battery to support self-consumption of residential solar energy.
- Stand-alone power systems—Western Power delivery of up to 60 Stand-alone Power Systems expected in 2019 in regional areas as part of SPS Round 1.
- Generator Interim Access (GIA) allows generators to connect to Western Power's network while the Government's Electricity Sector Reform Initiatives are progressing. Almost 900MW of additional renewable energy capacity is expected to be installed by 2022 (assuming all executed contracts proceed to completion).
- Kalgoorlie Solar Virtual Power Plant—Government has committed to develop a feasibility study for a potential solar virtual power plant on public housing in Kalgoorlie-Boulder.
- Albany Wave Energy Project—WA government has invested $3.75million for the Wave Energy Research Centre.
- Development of Western Australia's Renewable Hydrogen Industry, with the following key actions to date:
  - Renewable Hydrogen Council established to provide strategic advice and leadership.
  - Western Australian Renewable Hydrogen Strategy released on 18 July 2019.
  - Renewable Hydrogen Unit established to coordinate work on growing the industry.
  - $10 million Renewable Hydrogen Fund established to drive a new job-creating industry harnessing the State's renewable resources.
- $11.6 million investment to fund the installation of solar farms and energy storage in remote Aboriginal communities. The project will significantly reduce the cost of providing power to these towns which are 100 per cent diesel fuelled and will reduce the Government's subsidy paid to Horizon Power.

Transport

- The METRONET project expansion of rail connectivity throughout Perth's suburbs and Perth and Peel@3.5million—The Transport Network to support transport efficiency across the metropolitan area.
- The METRONET Sustainability Strategy supports the delivery of transport infrastructure projects and planning work for station precincts. The strategy incorporates various climate change mitigation and

adaptation initiatives, including: a rail network-level Climate Change Vulnerability and Risk Assessment to identify key risks and required controls; and a Station Precinct Resilience Assessment Framework.

- Requirements under the *State Supply Commission Act 1991* to minimise net greenhouse gas emissions associated with vehicles used by public authorities by maximising fuel efficiency and offsetting greenhouse gas emissions of the vehicle fleet.
- The Western Australian Bicycle Network Plan 2014–2031 and Your Move program encouraging greater use of cycling, walking and public transport and fewer trips by private vehicles.
- WA is a party to a memorandum of understanding regarding sub-national collaboration on electric vehicles committing to identify opportunities to collaborate in promoting and accelerating the transition to electric vehicles in Australia. A state working group has been established with three main work streams focusing on charging infrastructure; policies, standards and incentives; and increasing the number of electric vehicles in fleets.
- Expansion of the electric vehicle charging network in regional and remote WA through installation of more than 70 electric vehicle charge points.
- The Perth Parking Scheme contributes to balanced and sustainable transport outcomes by managing private vehicle access to central Perth and funding alternative access initiatives, services and infrastructure.

Other

- Western Australia's *Waste Avoidance and Resource Recovery Strategy* 2030: released in February 2019, the strategy aims to move Western Australia to a sustainable low-waste, circular economy in which human health and the environment are protected from the impacts of waste. The strategy contains objectives to avoid waste, recover more value and resources from waste and protect the environment by managing waste responsibly. The strategy recognises that waste generates greenhouse gases which can be reduced by avoiding and recovering waste.
- Western Australia's new container deposit scheme to start in June 2020—more than 170 refund points across the State to open on launch date with 229 refund points to open by the end of the scheme's first year—'Containers for Change' will provide a 10¢ refund for every eligible beverage container and help divert waste from landfill and create jobs for Western Australians.
- South West Hub Carbon Capture and Storage Project —The project has now finished with results publicly available through the Department of Mines, Industry Regulation and Safety. The results have bolstered the confidence that the South West Hub project area could meet its specified success criteria of injecting at least 800, 000 tonnes of CO2 per annum over 30 years.
- A Chief Health Officer's Inquiry into the impacts of climate change on health in Western Australia will be conducted to review the State's health system's capacity to respond to the effects of climate change, strengthen how communities and health services address key climate change vulnerabilities, and make preparations to reduce harmful health impacts for Western Australians. The inquiry's final report is due by the end of 2019.

Fifty-three contracted Emissions Reduction Fund projects.

Adaptation

- State Planning Strategy 2050 addresses climate change as a significant factor directly influencing Western Australia's future development.

- Better Urban Forest Planning is a guide to support enhancement of urban forests in WA through active planning, management, and care of the urban forest to help mitigate and improve resilience to climate change.
- State Planning Policy 7 Design of the Built Environment (Design WA) promotes delivering urban design that can help mitigate and improve resilience to climate change.
- Draft Position Statement: Renewable energy facilities has been adopted by the Western Australian Planning Commission to ensure that renewable energy facilities are positioned to minimise environmental impact while maximising production returns and operational efficiency. It outlines key planning and environmental considerations for the location, siting and design of renewable energy facilities.
- Coastwest and Coastal Management Plan Assistance Programs provide technical advice and financial support, of $1 million per year, to coastal local governments and community partnerships for planning and management that includes consideration of climate change impacts, monitoring and adaption measures. Approximately $1 million is available per year.
- State Planning Policy 2 Environment and Natural Resources Policy—Policy measure 5.10 addresses greenhouse gas emissions and energy efficiency including supporting the adoption of adaptation measures to respond to climate change.
- State Planning Policy 2.6 State Coastal Planning Policy requires consideration of climate and sea level rise (0.9 m over a 100-year planning timeframe to 2110) and coastal hazard risk management and adaptation planning when approving a development.
- State Planning Policy 2.9 Water Resources—recognises the impact of climate change on water resources and the need to address flood risk; requirement to take into account total water cycle management and water-sensitive urban design principles.
- The WA Coastal Zone Strategy provides a whole of Government integrated framework for collective action to manage and adapt to threats and pressures along the Western Australian coast.
- State Planning Policy 3.7 – Planning for Bushfire Prone Areas (2015) provides state-wide guidance and requirements for building and development in identified bushfire prone areas.
- Main Roads Western Australia standards for road and traffic engineering incorporate climate change considerations, and climate change risk assessments are undertaken for all projects costing more than $100 million and for various projects between $20 million and $100 million where climate change is an identified material issue.
- Coastal Adaptation and Protection annual grant program provides technical support and financial assistance, a total of $1 million per year, to local projects that identify and manage coastal hazards.
- Groundwater Replenishment Scheme—reduces reliance on climate dependent water sources such as surface water and groundwater for public water supply.
- *Be Groundwater Wise* information campaign launched on social media with a key message on the impacts of climate change on groundwater and the important role of groundwater in the state's water supply.
- Water Allocation Plans—future climate projections are being incorporated into water resource modelling and allocation planning for the Gnangara, Fitzroy catchment, Cockburn, Serpentine, Murray, Warren-Donnelly, Gingin, Arrowsmith, Jurien, Albany and hinterlands, Myalup, and Esperance plan areas.

Glossary

Term	Description
Abatement	Emissions reductions, removals or avoidance. When referring to a particular policy or measure it refers to the emissions reductions and/or removals that would not have occurred without that policy or measure.
Adaptation	Adjusting natural or human social or economic systems in response to actual or expected impacts of climate change that moderates harm or takes advantage of beneficial opportunities.
Afforestation	*Afforestation* is a subset of l*and converted to forest land* and includes only those forests established since 1 January 1990 on land that was clear of forest on 31 December 1989. Forests under *land converted to forest land* may be established through planting events either for commercial timber or for other reasons, known as 'environmental plantings', or by regeneration from natural seed sources on lands regulated for the protection of forests.
Australian Carbon Credit Unit	Units issued by the Australian Government under the ERF or the former CFI for abatement from registered project activities. Each unit represents 1 tonne of CO_2-e.
Australian Greenhouse Emissions Information System (AGEIS)	AGEIS centralises Australia's emissions estimation, inventory compilation and reporting, and data storage activities. Further information is available on the AGEIS website at www.ageis.climatechange.gov.au
Carbon capture and storage	Technology to capture and store greenhouse gas emissions from energy production or industrial processes. Captured greenhouse gases have the potential to be stored in a variety of geological sites.
Carbon-dioxide (CO_2)	A naturally occurring gas; it is also a by-product of human activities such as burning fossil fuels and biomass, land-use changes and some industrial processes.
Carbon-dioxide equivalent (CO_2-e)	A standard measure of emissions that expresses the amount of a greenhouse gas in terms of the amount of CO_2 that would trap the same amount of heat in the atmosphere. It is calculated by multiplying the amount of emissions of a gas by that gas's GWP. Total emissions are calculated by adding the CO_2-e emissions of each greenhouse gas.
Carbon Farming Initiative (CFI)	A voluntary scheme established in 2011 that allowed landholders to generate Australian Carbon Credit Units for abatement activities in the land sector. The CFI was replaced by the ERF in 2014, which expanded the model to incentivise abatement across the Australian economy.
Carbon neutral	Reducing emissions where possible and then investing in carbon offset projects to achieve zero overall emissions.
Carryover	Surplus emission units 'carried over' from a prior Kyoto Protocol commitment period and used in the next period.
COAG (Council of Australian Governments)	The peak intergovernmental decision-making forum in Australia including the Australian Government's Prime Minister, state and territory governments' First Ministers and the President of the Australian Local Government Association.

Term	Description
COAG Energy Council	The ministerial forum for the Commonwealth of Australia, states and territories of Australia and New Zealand, to work together in the pursuit of national energy reforms.
Deforestation	Converting forested land to an alternative, non-forest use. *Deforestation* under KP classifications is a subset of *forest conversion* and includes only lands where there has been direct human-induced conversion of forest to alternative land uses since 1 January 1990.
Demand management	The modification of consumer demand for energy through various methods such as load reduction, load shifting or use of onsite generation, particularly during extreme peak electricity demand.
Dispatchable generation	A source of electricity (e.g. a power plant) which can adjust their output supplied to the electrical grid on demand.
Domestic / national emissions	Greenhouse gas emissions and removals, resulting from human (anthropogenic) activities in Australia and external territories.
Emissions	Greenhouse gases released into the atmosphere.
Emissions budget	A method of accounting towards a target that sets the total amount of emissions allowed over multiple years (also called a Carbon budget).
Emissions factor	The quantity of greenhouse gases emitted per unit of some specified activity.
Emissions intensity	The total emissions divided by the total energy content of the fuels or the total energy used in a sector. The overall emissions intensity of coal used in Australia, for example, is determined by the quantity and emission factors for each of the many types and grades of coal used. Emissions intensity can also be calculated as the total emissions divided by a country's gross domestic product.
Emissions per capita	The total emissions divided by the total population, expressed as an amount of carbon dioxide equivalent emissions per person.
Emissions Reduction Fund (ERF)	Australia's central mechanism for achieving emission targets. The ERF consists of three elements: • crediting abatement by issuing Australian Carbon Credit Units to registered projects • purchasing abatement through reverse auctions • safeguarding purchased abatement to ensure it is not offset by significant increases in emissions above business-as-usual levels elsewhere in the economy.
Energy efficiency	Outputs relative to energy used. Improved energy efficiency means you can increase output from the same amount of energy, or reduce the amount of energy used for the same outcome. This can reduce both energy input costs and emissions.
Energy productivity	Energy efficiency as it relates to economic activity. Improved energy productivity means increasing economic output relative to the energy used.
Energy security	The uninterrupted availability of energy sources at an affordable price.
Enteric fermentation	The process in animals by which gases, including methane, are produced as a by-product of microbial fermentation associated with digestion of feed.
Extreme weather event	A weather event that is rare at a particular place and time of year. 'Rare' can be defined as being in the 10th or 90th percentile of the probability observed from past trends.

Term	Description
Fit and proper person test	Under Part 4 of the *Carbon Credits (Carbon Farming Initiative) Act 2011*, a person passes the fit and proper person test if: a) the person is a fit and proper person; and b) the person is not an insolvent under administration; and c) the person is not a Chapter 5 body corporate For more information see: https://www.legislation.gov.au/Details/C2017C00076
Flaring	The process of combusting unwanted or excess gases and/or oil at a crude oil or gas production site, a gas processing plant, oil refinery or waste disposal site.
Full Carbon Accounting Model (FullCAM)	FullCAM estimates emissions and removals from the LULUCF sector and KP LULUCF activities. It applies techniques described in the IPCC 2014 revised methods.
Fugitive emissions	Emissions that are released in connection with, or as a consequence of, the extraction, processing, storage or delivery of fossil fuel. Fugitive emissions do not include emissions released from the combustion of fuel for the production of useable heat or electricity.
Global Warming Potentials (GWP)	Represents the relative warming effect of a unit mass of a gas compared with the same mass of CO_2 over a specific period. Multiplying the actual amount of gas emitted by the GWP gives the CO_2-equivalent emissions.
Greenhouse gases	Gases that contribute to global warming, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). In addition, the photochemically important gases—NMVOCs, oxides of nitrogen (NO_x) and carbon monoxide (CO)—are also considered. NMVOC, NO_x and CO are not direct greenhouse gases. However, they contribute indirectly to the greenhouse effect by influencing the rate at which ozone and other greenhouse gases are produced and destroyed in the atmosphere.
Hydrofluorocarbons (HFCs)	Used as substitutes for ozone depleting substances such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs).
Intergovernmental Panel on Climate Change (IPCC)	The international body responsible for assessing the state of knowledge about climate change. The IPCC increases international awareness of climate change science and provides guidance to the international community on issues related to climate change response.
Kyoto Protocol (KP)	The Kyoto Protocol to the convention on climate change was developed through the UNFCCC negotiating process. The protocol was negotiated in Kyoto, Japan, in 1997. It sets binding greenhouse gas emissions targets for UNFCCC developed country Parties that ratify the agreement. The first commitment period of the KP ran from 2008–2012. In 2012 Parties to the KP agreed to the Doha Amendment, establishing a second commitment period (CP2) to run from 2013–2020. The CP2 is yet to enter into force.
KP First Commitment period	The period (2008–2012) in which developed country Parties (defined as KP Parties that are listed in Annex I to the UNFCCC are required to meet the first round of their emissions reduction obligations under the KP.
KP Second Commitment period	The period (2013–2020) in which Parties that have taken on a second round of commitments under the KP are required to meet these commitments. These commitments are inscribed in the Doha Amendments to the KP, which is yet to enter into force.

Term	Description
Land use, land-use change and forestry (LULUCF)	The greenhouse gas inventory sector covering emissions and removals from land and forests caused by human activities. This sector does not include emissions from the Agriculture sector, such as emissions from livestock or fertilisers applied to croplands.
Measures	Past, current or committed Australian, state or territory, or local government policy actions that reduce greenhouse gas emissions.
Mitigation	Human intervention to reduce or avoid emissions or to remove greenhouse gases from the atmosphere.
Montreal Protocol on Substances that Deplete the Ozone Layer	An international agreement, adopted in 1987, that controls the consumption and production of chemicals that destroy stratospheric ozone, such as chlorofluorocarbons.
Nameplate capacity	Intended full-load sustained output of a facility. Number registered with authorities for classifying the power output of a power station usually expressed in megawatts (MW)
National Electricity Market	The wholesale market through which generators sell electricity in eastern and southern Australia. The main customers are energy retailers, which bundle electricity with network services for sale to residential, commercial and industrial energy users.
National inventory report (NIR)	Detailed information on Australia's greenhouse gas emissions and removals from 1990 to the present. Prepared in accordance with international rules as part of Australia's National Greenhouse Accounts and used by the Australian Government to meet its international reporting obligations, track progress towards its international emission reduction commitments, and inform and monitor the effectiveness of domestic climate policy.
Permanence obligations	Under the Emissions Reduction Fund scheme, a permanence obligation means the carbon stored by a project must be maintained for the chosen period, either 100 or 25 years.
Perfluorocarbons (PFCs)	Used as substitutes for ozone depleting substances such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs).
Projections	Anticipated future emissions. The Australian Government publishes projections each year.
Quantified Economy-wide Emissions Reduction Target (QEERT)	2020 targets set by developed country Parties under the UNFCCC. QEERTs are expressed as a point target. However, Parties can take different approaches to account towards their target. Australia's QEERT is a five per cent reduction on 2000 emissions. Australia accounts towards its QEERT by reference to a carbon budget.
Reforestation	*Reforestation* is a subset of *land converted to forest land* and includes only those forests established since 1 January 1990 on land that was clear of forest on 31 December 1989. Forests under *land converted to forest land* may be established through planting events either for commercial timber or for other reasons, known as 'environmental plantings', or by regeneration from natural seed sources on lands regulated for the protection of forests.
Renewables	Renewable energy sources.
Sink	Any process, mechanism or activity that removes greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

Term	Description
Smart grid	The application of information, communications and control technology to improve the efficiency and effectiveness of electricity networks.
Solar photovoltaic (PV)	Solar cells that convert sunlight directly into electricity. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the PV effect.
Stationary energy emissions	Emissions from the generation of electricity by combustion of fuels and emissions from the direct combustion of fuels, predominantly in the manufacturing, construction and commercial sectors.
Statutory authority	A body created by Australian Government legislation that is a separate legal entity from the Commonwealth (Australian Government) and which has the power to hold money on its own account.
Target	An emissions goal set by a Party to the UNFCCC and/or the KP. Targets may aim to reduce emissions or limit growth in emissions. Targets may be expressed as a point target (by reference to an emission level at a point in time) or a carbon budget.
Tier	The IPCC methods for estimating emissions and removals are divided into 'tiers' encompassing different levels of activity and technology detail. Tier 1 methods are generally very simple (activity multiplied by default emissions factor) and require less data and expertise than the most complicated tier 3 methods. Tier 2 and 3 methods generally require more detailed country-specific information on things such as technology type or livestock characteristics. The concept of tiers is also used to describe different levels of key source analysis, uncertainty analysis, and quality assurance and quality control activities.
Time horizon	A fixed future point in time at which a process will end and/or be evaluated.
Trajectory	The pathway of emissions over time.
Units	Sometimes referred to as carbon or emissions units, these typically exist as electronic records. Each unit represents 1 tonne of CO2-e. A unit may represent an allowance to emit where emissions are regulated, or abatement that has been achieved under a particular program. They may be issued for use to meet international targets, or under domestic schemes. The most common units used towards international targets are accounting units issued under the KP, namely: assigned unit amounts (AAUs), emissions reduction units (ERUs), certified emissions reductions (CERs), and removal units (RMUs). There is provision for other types of units to be issued under the UNFCCC, although none exist at present. Parties may also establish their own mechanisms to issue units that can be used towards international targets. Units issued for domestic mechanisms are not used towards international targets. For example, Australia cannot use Australian Carbon Credit Units issued under the ERF to help meet its targets.
United Nations Framework Convention on Climate Change (UNFCCC)	An international environmental treaty, adopted in 1992 and entered into force in 1994, aimed at achieving the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
Voluntary action	Individuals and companies offsetting their emissions to become 'carbon-neutral' and households buying GreenPower (a government-accredited program for energy retailers to purchase renewable energy on behalf of customers). Voluntary action achieves emissions reductions additional to—that is, above and beyond—national targets.

Abbreviations and acronyms

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ACCU	Australian Carbon Credit Unit
ACIAR	Australian Centre for International Agricultural Research
AEMO	Australian Energy Market Operator
AES	Australian Energy Statistics
AGEIS	Australian Greenhouse Emissions Information System
ANAO	Australian National Audit Office
ANREU	Australian National Registry of Emissions Units
ARENA	Australian Renewable Energy Agency
AUASB	Australian Auditing and Assurance Standards Board
BoM	Bureau of Meteorology
BPP	Business Partnerships Platform
CBD	Commercial Building Disclosure
CCA	Climate Change Authority
CCS	Carbon capture and storage
CCXG	Climate Change Experts' Group
CEFC	Clean Energy Finance Corporation
CER	Clean Energy Regulator
CFI	Carbon Farming Initiative
CNG	Compressed Natural Gas
COAG	Council of Australian Governments
COD	Chemical Oxygen Demand
CP	Commitment Period
CRC	Cooperative Research Centre
CSF	Climate Solutions Fund
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSP	Climate Solutions Package
CTF	Common Tabular Format
DAC	Development Assistance Committee
DFAT	Department of Foreign Affairs and Trade
DKIS	Darwin-Katherine Interconnected System
ERAC	Emissions Reduction Assurance Committee
ERF	Emissions Reduction Fund
ESOO	Electricity Statement of Opportunities
F-gas	Fluorinated gases
FullCAM	Full Carbon Accounting Model
GDP	gross Gross domestic product
GHG	Greenhouse gas
GSOO	Gas Statement of Opportunities
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
IEA	International Energy Agency

IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IT	Information Technology
JCPAA	Joint Committee of Public Accounts and Audit
KP	Kyoto Protocol
LGC	Large-scale Generation Certificate
LNG	Liquefied natural Natural Ggas
LPG	Liquefied Petroleum Gas
LRET	Large-scale Renewable Energy Target
LULUCF	Lland use, land-use change and forestry
LUTO	Land Use Trade-Offs
MRV	Mmeasurement, reporting and verification
NABERS	National Australian Built Environment Rating System
NatHERS	Nationwide House Energy Rating Scheme
NCC	National Construction Code
NEM	National Electricity Market
NEPP	National Energy Productivity Plan
NEVS	National Electric Vehicle Strategy
NGER	National Greenhouse and Energy Reporting Act 2007 (Cth)
NGERS	National Greenhouse and Energy Reporting Scheme
NGO	Non-Government Organisation
NIR	National inventory report
NRM	Natural Resources Management
NURG	National Inventory Users Reference Group
OCE	Office of the Chief Economist
ODA	Overseas Development Assistance
OECD	Organisation for Economic Co-operation and Development
PFAN	Private Financing Advisory Network
PFC	Perfluorocarbons
PV	Photovoltaic
QA	Qquality assurance
QC	Qquality control
QEERT	Quantified Economy-wide Emission Reduction Target
R&D	Research and development
RET	Renewable Energy Target
SDG	Sustainable Development Goals
SRES	Small-scale Renewable Energy Scheme
SWIS	South West Interconnected System
UNFCCC	United Nations Framework Convention on Climate Change
WEM	Wholesale Electricity Market

Gases

CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
HFCs	Hydrofluorocarbons
LNG	Liquified Natural Gas
N_2O	Nitrous oxide
NF_3	Nitrogen fluoride
NMVOC	Non-methane volatile organic compounds
NO_X	Nitrogen oxides
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
SO_x	Sulphur oxides

Units

CO_2-e	carbon dioxide equivalent
Gg	gigagrams
GW	gigawatts
kg	kilograms
kt	kilotonnes (thousand tonnes)
Mt	megatonnes (million tonnes)
MW	megawatts
t	tonnes

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