Chapter 1. Environmental performance: Trends and recent developments

This chapter highlights progress made in decoupling economic activity from environmental pressures in Australia since 2005. The chapter presents the main economic and social developments. It then reviews Australia's progress in reducing the energy and carbon intensity of its economy, in making the transition to a resource-efficient economy and in managing its natural asset base. The chapter also summarises key policy developments in areas including energy, climate change, air, water and biodiversity.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1.1. Introduction

Australia, the world's sixth largest country, is endowed with a wide variety of natural resources. It is one of 17 megadiverse countries and among the top ten largest greenhouse gas (GHG) emitters in the OECD. The country's steady economic growth has helped improve the living standards of a growing population. This growth has been driven by a strong service sector and abundant natural resources, which remain important exports. However, economic activity has been putting pressure on the environment, especially on water resources and biodiversity. Climate change adaptation is a growing challenge.

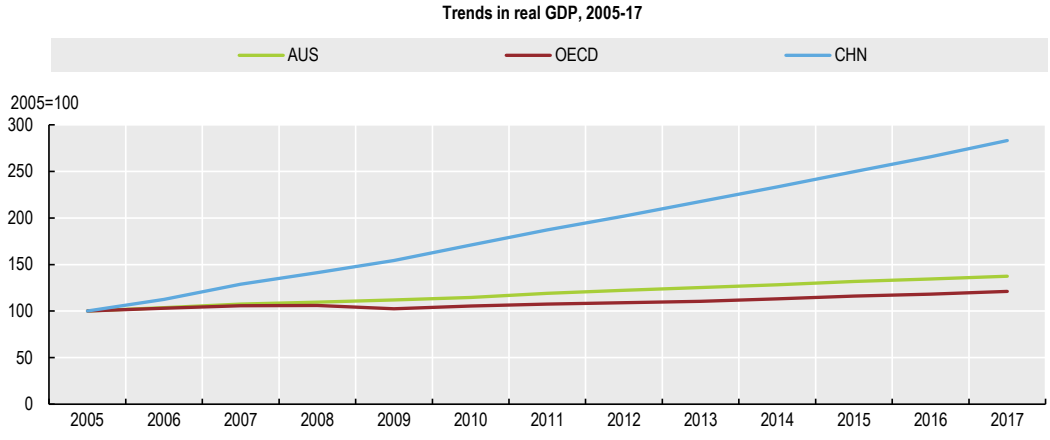
This chapter provides an overview of Australia's environmental achievements since 2005, and its remaining challenges. It assesses the country's progress against national policy goals and international commitments. It also provides, to the extent possible, international comparisons in terms of environmental state and trends. The chapter sketches out major policy developments in environmental sectors including air, climate, waste, water and biodiversity.

1.2. Main economic and social developments

1.2.1. Economic performance

Australia experienced uninterrupted economic growth since 1992, with a growth rate in gross domestic product (GDP) averaging about 3%. This growth has largely been driven by emerging economies' demand for energy and mineral resources. The economy withstood the global financial crisis thanks to reactive macroeconomic policy responses, high commodity prices and a solid financial system (Figure 1.1; IEA, 2012; OECD, 2017a). It is expected to continue growing at a rapid pace in 2019 (OECD, 2017b). Although all states and territories have experienced growth in recent years, considerable disparity remains. The growth rates in resource-intensive Queensland and Western Australia were generally above the national average, while the Australia Capital Territory, South Australia and Tasmania fell behind the national rate (DIIS, 2016).

Figure 1.1. The Australian economy withstood the global financial crisis



Source: OECD (2018), *OECD National Accounts Statistics* (database).

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Exports account for about 22% of GDP (Basic statistics), and Australia ranks among the top exporters of iron ore, coal, gold and natural gas, along with education services. It imports motor vehicles, refined petroleum and telecom equipment. Its terms of trade, which peaked in 2011, grew with large increases in export prices for certain commodities, such as iron ore and coal. With around 30% of its exports destined for the People's Republic of China, Australia reaped the benefits of that country's growing economy. The slowdown in China's GDP growth between 2007 and 2016 translated into lower demand for iron ore and coal. This demand will continue to be a determinant of Australia's output growth. Productivity growth has been weak in recent years (OECD, 2017a).

Australia's fiscal position is sound and the tax burden low. Large transfers from central government compensate the imbalance between state spending and revenue (OECD, 2017a). Revenue from environmentally related taxes declined from 2.2% of GDP in 2005 to 1.8% in 2016 but remains above the OECD average of 1.6% (Basic statistics; Chapter 3).

1.2.2. Structure of the economy and employment

The economy is highly reliant on natural resources. Extraction of subsoil assets, mainly iron ore, contributed more than 0.3% percentage points to GDP growth between 2005 and 2012, among the highest values in the OECD (Cárdenas Rodríguez et al., 2016). Industry accounts for 25% of value added, split among construction (9%), manufacturing (7%), mining and quarrying (6%) and electricity and others (3%) (OECD, 2017c).

The structure of the economy is similar to that of the OECD, with a large service sector (Basic statistics). Most of the value added in services comes from real estate activities, followed by financial and insurance activities. Tourism has been growing faster than the economy, reaching 8 million tourists in 2016. Australia also attracts a growing number of international students (Deloitte, 2017). Agriculture's 3% share of value added is above the OECD average (Basic statistics).

Although the unemployment rate (5.6%) has been decreasing in recent years and remains below the OECD average, it hides a rise in part-time and underemployment in a highly flexible labour market (Basic statistics). The unemployment rate varies across states and territories, from about 4% in the Australian Capital Territory to about 6% in Queensland and Tasmania (ABS, 2018a). The trend also differs: unemployment has decreased in New South Wales and Victoria but increased in the mining regions of Western Australia (DIIS, 2016). Women's labour force participation rate is slowly progressing but is still below men's, and the pay gap remains high (OECD, 2018a). Indigenous people's workforce participation is low: Aboriginals and Torres Strait Islanders are considerably less likely to be employed than non-Indigenous people (ABS, 2016). Although youth unemployment is below the OECD average, it has been increasing recently and reached about 13% in 2017 (OECD, 2018b).

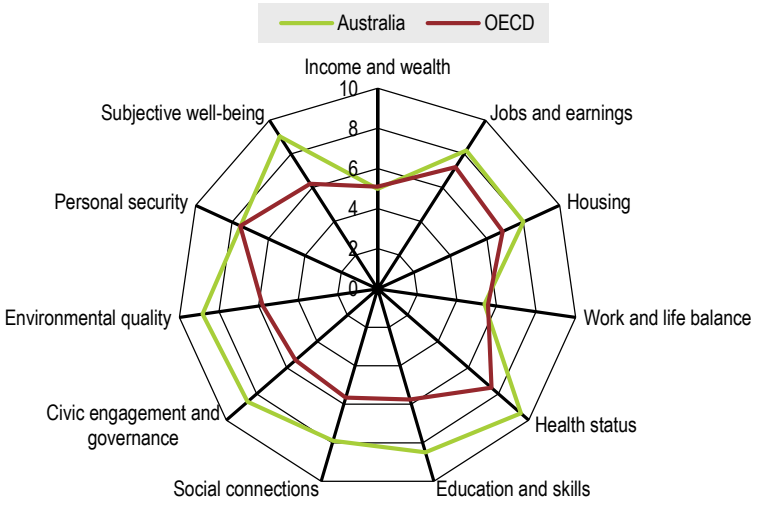
1.2.3. Population, well-being and quality of life

Australia is among the world's less densely populated countries (Basic statistics). The population has increased by more than 20% since 2005, mostly driven by international migration, and is projected to reach more than 30 million by 2050 (UN DESA, 2017). New South Wales is the most populated state with 32% of the population, followed by Victoria (26%) and Queensland (20%). Most people live in urban areas, which cover a small share of land area and are mainly located in coastal regions. Indigenous Australians account for 3.3% of the population; 91% are Aboriginal, 5% are Torres Strait Islanders

and 4% are from both origins (ABS, 2018b). Although their income and level of education have improved, they do not enjoy the same living standards as the rest of the population in terms of life expectancy and employment.

Australia ranks in the top third of OECD countries in terms of GDP per capita and performs very well in many dimensions of the OECD Better Life Index (Basic statistics; Figure 1.2). Average disposable income per capita is above the OECD average, but there is a large gap between richest and poorest. As voting is compulsory, the country ranks high on civic engagement. The average Australian student scores better than the OECD average in the OECD Programme for International Student Assessment. The country performs well in terms of environmental quality, too, thanks to low levels of $PM_{2.5}$ and a population satisfied with water quality (OECD, 2017d).

Figure 1.2. Australia performs well in the OECD Better Life Index



Note: Each well-being dimension is measured using one to three indications from the OECD Better Life Indicator set with equal weights. Indicators are normalised by re-scaling to be from 0 (worst) to 10 (best).
Source: OECD (2017), *OECD Better Life Index 2017.*

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The Commonwealth government does not regularly monitor environmental awareness. In its latest survey (ABS, 2010), 82% of Australian adults reported that they were concerned about at least one environmental issue, such as drought, bushfires, water conservation or climate change. While a growing majority of people trust climate science, trust in leadership to take action on climate change has eroded. Most respondents see economic benefits from climate action (The Climate Institute, 2016). A large majority of Australians are concerned about climate change impacts resulting in droughts and flooding, and in destruction of the Great Barrier Reef (The Australia Institute, 2018a).

1.2.4. Progress towards the Sustainable Development Goals

So far, Australia has no overarching plan for implementing the 2030 Agenda for Sustainable Development. Some strategies and policies at the Commonwealth and state/territory levels are nonetheless relevant for the Sustainable Development Goals (SDGs) (Annex). Parliament has undertaken an initial inquiry to assess possible benefits and costs of achieving meaningful outcomes as well as the governance structure needed.

Australia's first voluntary national review on the 2030 Agenda presents efforts and challenges for each of the 17 SDGs. It compiles good practices drawing from stakeholder activities that are also showcased on an online platform (DFAT, 2018). Building on consultation with stakeholders, this review provides a basis for preparing a national 2030 Agenda implementation plan (Chapter 3). It is complemented by a user-friendly website that lays the groundwork for tracking progress. Continued effort is needed to report and evaluate progress on available indicators and improve the coverage of indicators reported online.

1.3. Transition to a low-carbon and energy-efficient economy

1.3.1. Energy supply and demand

Main policies and measures

The 2015 Energy White Paper is the overarching energy policy document (Department of Industry and Science, 2015). Published before ratification of the Paris Agreement, it calls for increasing competition to keep prices down and securing investment in the sector. It also endorses increasing energy productivity through implementation of the National Energy Productivity Plan (NEPP). In the past decade, energy and climate policies have shown significant instability, which has challenged investor confidence in planning new energy infrastructure (Finkel et al., 2017). The introduction and revoking of the carbon pricing mechanism and the recent step back on the National Energy Guarantee are key examples (Chapter 3). Therefore, there is a need to adopt a national, integrated energy and climate policy framework for 2030 based on a long-term emission reduction strategy.

Unexpected closures of old coal plants, gas exports that have constrained domestic supply and cases of power outages have highlighted risks to energy security and reliability. The rapid development of renewable energy resources requires investment and regulatory changes to ensure their system integration in the National Electricity Market (NEM). These developments have prompted the government to undertake reforms on various fronts (IEA, 2018a).

Energy supply and electricity generation

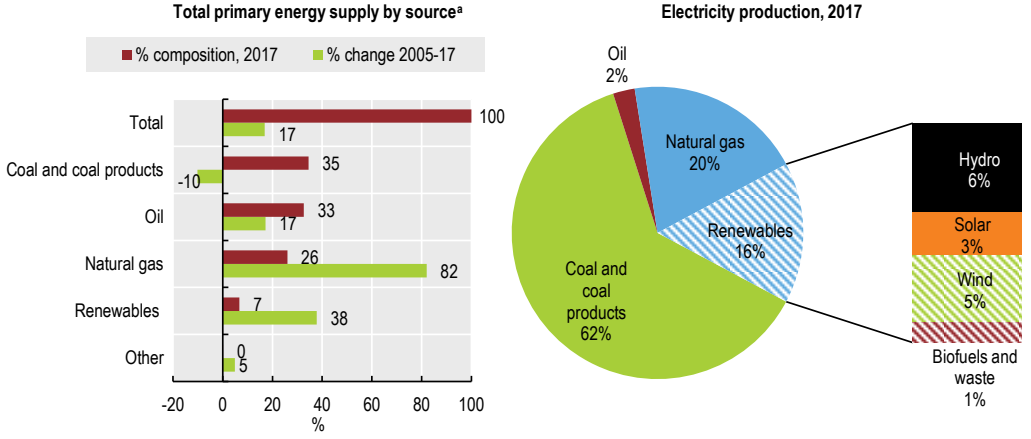
Australia is endowed with an abundance of energy resources, including fossil fuels (coal, natural gas, oil) and renewables (wind, solar, geothermal, wave, tidal and biomass), as well as uranium (Geoscience Australia et al., 2018). It is the second largest coal-producing country in the OECD and the world's largest exporter. It also has become a leading exporter of liquefied natural gas (LNG), rivalling Qatar and the United States. Australia holds one-third of the world's proven uranium reserves but has no operating nuclear power plant (DIIS, 2017; IEA, 2018a; Section 1.5.3).

Australia ranks among the OECD countries with the highest shares of fossil fuels in the energy mix (93%, compared with the OECD average of 80%). Coal and oil each account for about a third of the total primary energy supply (TPES), followed by natural gas, whose share has grown significantly (Figure 1.3). The shares of renewables in energy supply and electricity generation have increased rapidly but remain below the OECD averages of 10% and 25%, respectively (Figure 1.4).

CO_2 intensity of electricity generation is almost double the OECD average owing to the large share of coal (IEA, 2018b). Emission intensity has been declining since 2009 due to a shift towards natural gas and renewables. The energy system is changing, as ten old

coal-fired power plants have closed since 2012 and several more are scheduled to do so (IEA, 2018a). However, coal use in electricity generation has increased since 2014 (Section 1.3.3).

Figure 1.3. Coal dominates the energy mix but natural gas and renewables are growing



a) Breakdown excludes electricity trade. Other: non-renewable waste.
Source: IEA (2018), *IEA World Energy Statistics and Balances* (database).

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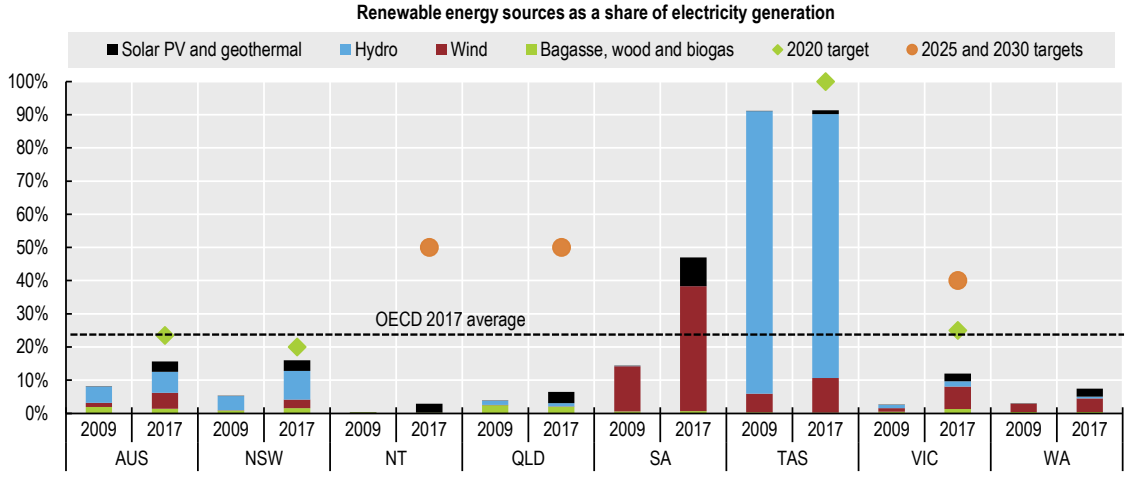
Renewable energy sources

Australia has untapped potential for renewables. Electricity generated by solar and wind has rapidly increased over the past decade and is expected to continue growing (IEA, 2016). The concentration of variable renewables in a few states is leading to system integration challenges in the NEM. More than 20% of dwellings have solar photovoltaic installations, a growing number of which are combined with batteries (APVI, 2018). Biofuels and waste are the main sources of renewable energy supply, most of which is used in the food industry.

The Commonwealth supports renewables development in the power sector with the Renewable Energy Target, a green certificate for both large- and small-scale installations. The country is on track to meet its 2020 large-scale target of 33 000 GWh thanks to a record level of investment in renewables in 2017 (CER, 2018). In addition, state and territory governments run auctions and provide feed-in tariffs (Chapter 3). Progress is slower in heating and transport (IEA, 2018a). Some state and territory governments have adopted ambitious targets for renewables development beyond 2020 but there is no equivalent national target (Figure 1.4).

Figure 1.4. Renewables development is uneven across states and territories



Note: ACT is included in NSW. VIC's target is for 2025, NT and QLD targets are for 2030.
Source: DEE (2018), *Australian Energy Statistics*; Australian Government (2015), "Commonwealth amendments to the Renewable Energy Target"; ACT Environment and Sustainable Development Directorate (2011), "ACT Sustainable Energy Policy 2011-2020"; NSW (2013), "Renewable Energy Action Plan"; NT (2017), "Roadmap to Renewables"; QLD (2017), "Powering Queensland Plan"; SA (2013), "Climate Change Strategy"; TAS (2013), "Climate Smart plan"; Victoria (2017), "Renewable Energy (Jobs and Investment) Act 2017".

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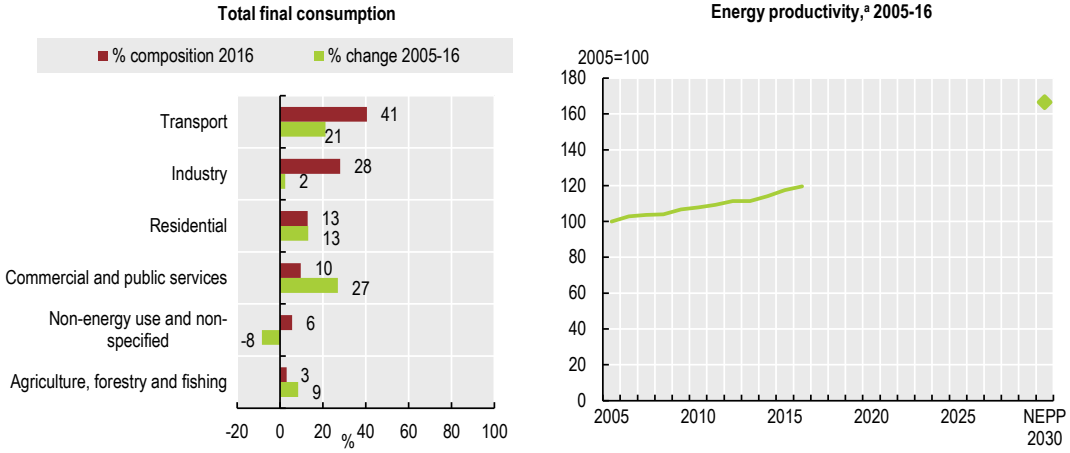
Energy intensity

Australia is in the upper range of the most energy-intensive OECD economies (expressed as TPES and TFC per unit of GDP) due to the importance of transport and the extractive and heavy industries. Nevertheless, energy intensity has decreased due to the shift towards the service sector, the closure of aluminium smelters and refineries, and improvement in energy efficiency, notably from more efficient appliances. Transport and industry are the largest energy consumers (Figure 1.5). Since 2005, energy use has particularly increased in commercial and public services, transport, mining and the food industry. Australia applies the Equipment Energy Efficiency Program to drive energy efficiency of appliances. However, many industry programmes have been closed, including the Energy Efficiency Opportunities programme.

The NEPP aims at increasing GDP per unit of energy used by 40% between 2015 and 2030. The greatest energy saving opportunities are identified as being in transport (43%), industry (28%) and the commercial and residential sector (25%) (Australian Government, 2015a). While market reforms are ongoing, measures with great potential, such as energy prices that reflect social and environmental costs, efficient vehicles, and updated energy efficiency requirements in the National Construction Code (to be updated in 2019), remain to be implemented (Chapter 3).

Although energy productivity has been steadily improving, the pace of change in recent years has not been rapid enough to reach the 2030 NEPP target (Australian Government, 2016, 2017). Achievement of the 2030 climate target is thus at risk, as the energy productivity target is expected to contribute between 25% and 40% of it (IEA, 2018a).

Figure 1.5. Progress in energy productivity is not fast enough to reach the 2030 target



a) Final energy consumption productivity. GDP expressed at 2010 prices and purchasing power parities.
Source: IEA (2018), *IEA World Energy Statistics and Balances* (database); OECD (2018), *OECD National Accounts Statistics* (database); Australian Government (2015), *National Energy Productivity Plan 2015-2030*.

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1.3.2. Transport

Australia's size, the dispersed locations of agricultural and mining activities and the high population density on the coasts shape its transport system. The transport sector is the highest energy consumer and the second fastest-growing source of GHG emissions. Road accounts for most energy use in the sector (83% in 2016), followed by air (10%) and rail (4%) (IEA, 2018c). Freight[1] is dominated by rail (56%) and road (29%), but when bulk transport is excluded, road is predominant (77%) (BITRE, 2017). Rail freight grew rapidly in the past decade with movements of iron ore. Road is the main passenger transport mode (64%[2]) and air the fastest growing one.

Car ownership is among the highest in the OECD (OECD, 2015a). The national vehicle fleet has an average age of ten years and has been steadily growing. Petrol is the dominant fuel, but the share of diesel in road fuel consumption increased from 31% in 2005 to 44% in 2016. The level of biofuel consumption in transport is still low (less than 1% in 2016) (IEA, 2018c), despite increased production and the introduction of national fiscal measures and of state biofuel mandates in New South Wales and Queensland (REN21, 2018).

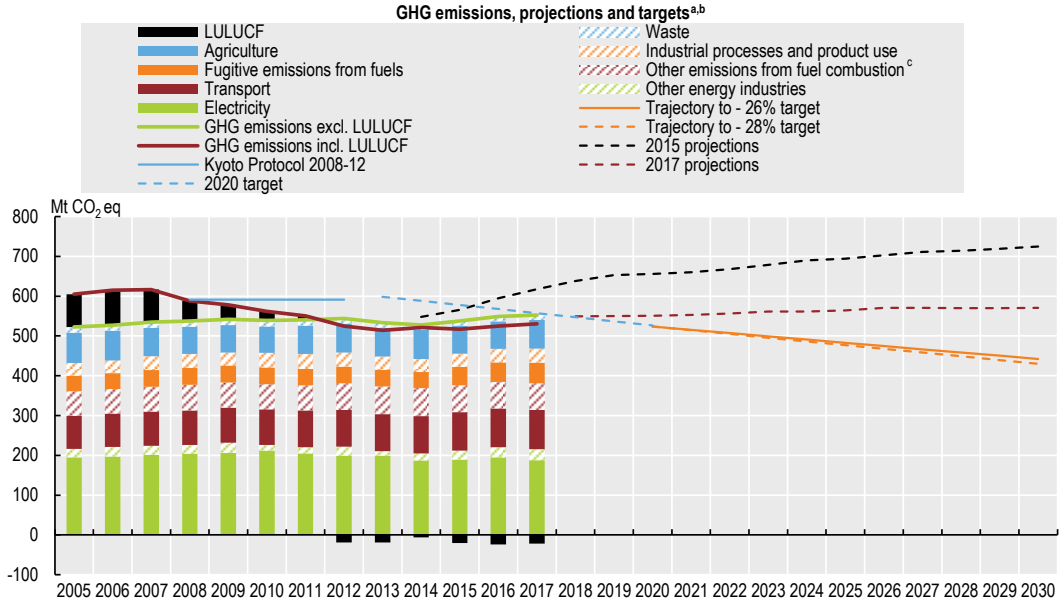
Fuel quality standards are below world best practice (IEA, 2018a). Australia does not have fuel efficiency or CO_2 emission standards, though both are under discussion in the Ministerial Forum on Vehicle Emissions. In 2016, average CO_2 emissions were 173 g CO_2/km for new cars and 222 g CO_2/km for light commercial vehicles. Although the levels have declined, they are considerably higher than the EU averages (118 g CO_2/km and 164 g CO_2/km) due to the high share of large vehicles and a lower proportion of diesel-powered engines (National Transport Commission, 2017).

1.3.3. Climate change mitigation and adaptation

Emission profile and intensity

GHG emissions decreased between 2005 and 2017, largely due to the decline in emissions from forest conversion, which helped reduce emissions from land use, land use change and forestry (LULUCF), a sector that Australia takes into account for reaching its international goals (Figure 1.6; DEE, 2017a). However, emissions are projected to have increased in 2017 and continue growing to 2030 (DEE, 2017b, 2018a). Over 2005-17, GHG emissions excluding emissions from LULUCF increased. Emissions from energy industries, the largest emitter, remained broadly constant: the decline of emissions from electricity[3] was offset by the rapid increase of emissions from natural gas production. Increased natural gas production for exports also resulted in a rise in fugitive emissions (DEE, 2018a).

Figure 1.6. Australia needs to intensify mitigation efforts to meet its 2030 target



a) GHG emissions including land use, land use change and forestry (LULUCF) follow the IPPC 2006 guideline, as reported to the UNFCCC through the national GHG inventory, while emissions reported under the Kyoto Protocol use specific accounting rules. The emission reduction target for the second commitment period (2013-20) of the Kyoto Protocol reflects the target under the 2010 UNFCCC Cancun Agreement: 5% reduction below 2000 levels. Australia is allowed to use the carryover emissions from the first commitment period of the Kyoto Protocol (128 Mt CO_2 eq) to meet its target for the second period.
b) The 2030 target is to reduce GHG emissions by 26-28% below 2005 levels, depending on opportunities to reduce emissions and factors such as technology costs. Australia assesses its progress towards its quantified economy-wide emission reduction target using a carbon budgeting approach.
c) Energy use in manufacturing industries and construction and other sectors, such as agriculture and commercial and residential.
Source: DEE(2018), "National Inventory Report 2016"; DEE (2017), "Australia's emissions projections 2017"; DEE (2018), "Quarterly Update of Australia's National Greenhouse Gas Inventory: May 2018".

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When LULUCF is excluded, Australia ranks among the top ten most GHG-emitting countries in the OECD and is one of the few OECD countries where emissions have grown over the past decade. GHG emissions per unit of GDP and per capita are among the highest in the OECD, despite declining levels. This reflects the country's low population density, importance of heavy and extraction industries and carbon-intensive energy mix (Section 1.3.1; DEE, 2017a). As in other OECD countries, CO_2 accounts for most of the GHG emissions.

New South Wales, Queensland and Victoria account for about a quarter of national emissions each. The breakdown of the states and territories' emissions generally reflects the national picture, although emissions from LULUCF are positive in the Northern Territory and Queensland (Assessment and Recommendations Figure 2).[4]

International targets and goals

Australia signed the Kyoto Protocol in 1998 and ratified it in 2007. The related 2008-12 target of limiting GHG emissions to 8% above 1990 levels was met without the use of flexibility mechanisms. Article 3.7 of the Kyoto Protocol,[5] which allows the inclusion of deforestation in base year emissions, and reduced emissions thanks to land clearing restrictions were key drivers of this achievement. Australia is allowed to carry over 128 Mt CO_2 eq, a quarter of its 2016 GHG emissions, to the second commitment period (CCA, 2014; DEE, 2017c). Under current projections, it will reach the 2020 target without this option. Some OECD countries (Denmark, Germany, the Netherlands, Sweden and the UK) decided to drop their emission surplus from overachieving the first commitment period.

Australia is expected to meet its 2020 unconditional target of reducing GHG emissions by 5% below 2000 (Figure 1.6; DEE, 2017c, 2017e; Rocha et al., 2015). Australia translated this 2020[6] pledge under the UN Framework Convention on Climate Change into a legally binding commitment for the Kyoto Protocol second commitment period (2013-20) (UNFCCC, 2012).

Australia ratified the Paris Agreement in 2016, with an unconditional economy-wide Nationally Determined Contribution (NDC) of reducing GHG emissions (including LULUCF) by between 26% and 28% below 2005 levels by 2030. It will implement the 28% target should circumstances allow, taking into account opportunities to reduce emissions and factors such as technology costs (UNFCCC, 2015). The Climate Change Authority recommended stricter targets (45% to 65% below 2005 levels by 2030), recognising they would be challenging but would bring major benefits in terms of avoiding harmful consequences of climate change and seizing opportunities arising from the low carbon transition – while the costs would largely depend on the measures adopted (CCA, 2015; DPMC, 2015). The NDC has been criticised as not representing a fair share of the global abatement task (The Australia Institute, 2018b; Climate Action Tracker, 2018).

The Australian government revises its GHG emission projections annually to account for new assumptions on, for example, change in electricity demand, falling technology costs, coal plants closures and changes in federal and state policies. As a result, GHG emission projections have been revised downward since the NDC was announced (in the 2015, 2016 and 2017 projections).

Climate change mitigation policies

The Paris Agreement calls for all countries to strive to develop low GHG emission development strategies including long-term emission goals in line with temperature limits of the Paris Agreement, which require cutting GHG emissions to near zero by the end of the century. The issue of climate has been a catalyst for political instability in the past decade. Although the Commonwealth does not have a legislated GHG reduction target for 2050 or a national climate change strategy (it committed to prepare a long-term plan by 2020), several states have developed their own. Climate strategies, with various time frames, exist in the Australian Capital Territory (2012 and 2018), New South Wales

(2016), Queensland (2017), South Australia (2015), Tasmania (2017) and Victoria, which enacted a Climate Change Act (2017) (Box 1.1). All these states and territories have set long-term targets (Assessment and Recommendations Figure 2). The Northern Territory, accounting for 2% of national emissions, and Western Australia, with 16%, have no mitigation target. It is unclear how Australia can ensure that climate targets are consistent across jurisdictions (e.g. there is no mechanism to fix a consensus-based vision as in Canada).

Box 1.1. Planning to reduce net GHG emissions to near zero after 2050

Holding the increase in the global average temperature to well below 2°C relative to pre-industrial levels is one of the objectives of the Paris Agreement. This requires cutting GHG emissions levels to near zero by the end of the century, with an early peak and a rapid fall, to stay within a fixed quantity of long-lived GHGs to be released to the atmosphere over time, known as a global carbon budget.

Some countries have adopted carbon budgets to better plan for the transition to a low-carbon economy. The UK was the first to set legally binding carbon budgets for five-year periods to reach an 80% reduction target (from the 1990 level). The independent Climate Change Committee reviews progress. In France, the National Low Carbon Strategy set a carbon budget and indicative sectoral carbon budgets to cut GHG emissions by 75% by 2050 (from the 1990 level). Current and future Swedish governments must produce annual climate reports in the budget bill, and prepare an action plan every four years for achieving emission targets, to reach the legally binding target of net zero emissions by 2045.

Victoria, which uses coal for more than 80% of its electricity generation, passed an important milestone to provide long-term clarity on mitigation and adaptation with the adoption of its Climate Change Act in 2017. The act includes a long-term target of net zero emissions by 2050 and creates a framework for developing five-yearly interim targets starting with 2021-25. It requires the state government to develop a climate change strategy every five years, setting out how the targets will be met and how adaptation will take place. The Australian Capital Territory is taking the same approach to reach net zero by 2045. Climate laws have the benefit of increased certainty.

Source: OECD (2017e), *Investing in Climate, Investing in Growth*, https://doi.org/10.1787/9789264273528-en; Parliament of Victoria (2017), *Climate Change Act*, www.legislation.vic.gov.au.

The role of various instruments for delivering emission reductions in Australia, interactions between them and the costs associated with the policy mix need to be further clarified (Chapter 3). Australia has adopted a piecemeal approach to emission reduction with instruments such as the Emissions Reduction Fund and its safeguard mechanism, the Renewable Energy Target, the Clean Energy Finance Corporation and the Australian Renewable Energy Agency (Chapter 3). States and territories have their own policies and instruments, such as feed-in tariffs and auctions to promote renewables and white certificate programmes for energy savings. While a review of Australia's climate change policies was undertaken in 2017, their role in reaching the Paris Agreement goals have not been specified (DEE, 2017d).

Climate change outlook and adaptation policy

Australia has warmed by 0.9°C over the past 60 years. Changes in rainfall patterns, more frequent hot days and heat waves are already affecting well-being and can have adverse effects on mental health and productivity. Seven of Australia's ten warmest years on record occurred over the review period. In addition to detectable rises in sea level, the surrounding oceans are expected to warm and become more acidic, exacerbating pressure on the Great Barrier Reef. Both extreme rainfall and drought are likely to become more intense. Increased smoke and dust from more frequent and severe bushfires are likely to affect air quality (CSIRO/BOM, 2015).

In 2015, the Australian government produced a National Climate Resilience and Adaptation Strategy, identifying action in priority areas based on the economic, social and environmental impact of climate change and its likely timing. The strategy presents a set of principles to guide effective adaptation and strengthen resilience (Australian Government, 2015b). It builds on the 2007 National Climate Change Adaptation Framework and the work of the National Climate Change Adaptation Research Facility, which since 2008 has provided a solid information base (e.g. for projections and risk studies). Australia is an important player for developing knowledge in the southern hemisphere, but both national and state/territory funds to support climate science have been significantly reduced (DEE, 2018b). For example, the Australian Climate Change Science Program (delivered jointly by the CSIRO and the Bureau of Meteorology) ceased in 2016, with reduced funding for climate change science research then provided under the National Environmental Science Program. Funding for the National Climate Change Research Facility ceased in 2018. Most states and territories have adopted adaptation strategies identifying climate change-related threats and opportunities across sectors. Many cities have done so as well. Local governments face challenges in effective adaptation, as they experience the impact but have limited resources (Productivity Commission, 2012; Parliament of Australia, 2018).

1.3.4. Atmospheric emissions and air quality

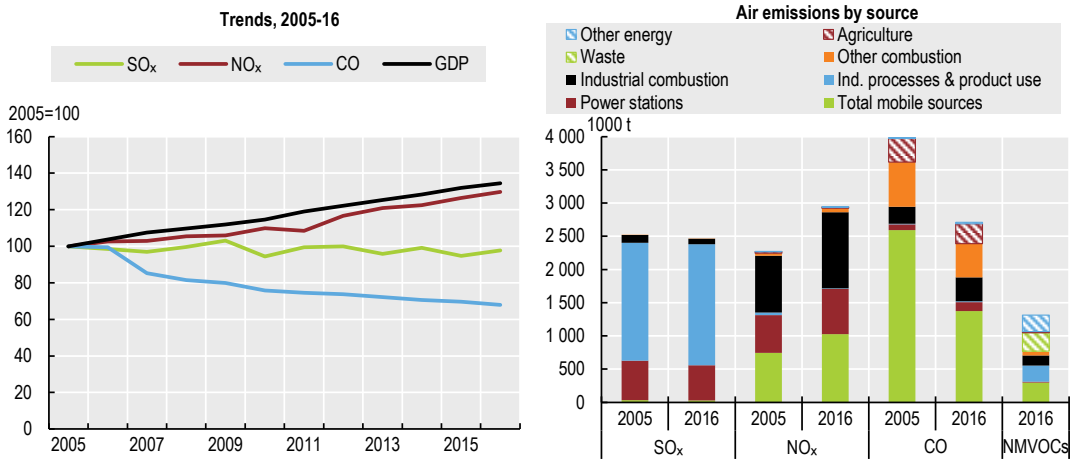
Main policies and measures

The National Environment Protection Measure for Ambient Air Quality is the main air quality regulatory framework, with states and territories implementing legislation to meet its standards (Chapter 2; Keywood, Hibberd and Emmerson, 2017). In 2015, environment ministers launched the National Clean Air Agreement, a framework for air quality management across jurisdictions, recognising challenges posed by rapid population growth, higher transport and energy demand, extraction and resource use, urbanisation and climate change (DEE, 2015). Stricter standards for particle reporting, agreed by environment ministers in all jurisdictions, have since come into effect and been formally adopted by most states and territories. The standards will need to be regularly reviewed to reflect the latest scientific evidence of health effects. The government is also progressing on enactment of rules on emissions from certain products (DEE, 2018c). It introduced the Product Emissions Standards Act in 2017, setting standards for non-road spark ignition engines and equipment, such as petrol-powered outdoor power equipment and marine outboard engines. The National Clean Air Agreement 2018-20 work plan identifies completing National Pollutant Inventory reforms as a priority (Chapter 5).

Air emissions

Australia is among the ten OECD countries with the highest emissions of air pollutants (SO_x, NO_x, CO and NMVOC) per unit of GDP and per capita. Improvements in motor vehicle engines, emission control technology and fuel standards have helped decouple CO emissions from GDP despite increased passenger and freight transport (Figure 1.7; Keywood, Hibberd and Emmerson, 2017). Emissions of particulate matter (PM_{10} and $PM_{2.5}$) have increased with mining, domestic wood heater use and motor vehicles, as well as natural sources. Most SO_x emissions come from industrial processes (metal smelting) and coal-fired electricity generation, and NO_x emissions from industrial combustion, followed by motor vehicles and power stations. Motor vehicles, prescribed burns and bushfires, and biomass burning in domestic wood heaters are the main sources of CO emissions. Emission sources vary by region and time. National Pollutant Inventory users recommend improving the quality of data on diffuse sources of emissions (Chapter 5; Keywood, Hibberd and Emmerson, 2017).

Figure 1.7. Air emissions have been further decoupled from economic activity



Source: OECD (2018), "Air and climate: Air emissions by source", *OECD Environment Statistics* (database); OECD (2018), *OECD National Accounts Statistics* (database).

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Air quality

Overall, air quality is good in Australia. Mean exposure to $PM_{2.5}$ is among the lowest in the OECD and below the World Health Organization guideline value of 10 micrograms per cubic metre ($\mu g/m^3$) (OECD, 2018c). Ambient PM pollution was still estimated to cause 127 premature deaths per million inhabitants, the welfare cost of which was equivalent to 1.2% of GDP in 2016 (OECD, 2018d).

Greater urban density, industrial activity and car use put continual pressure on air quality. Smoke from domestic wood heaters remains a major pressure on winter air quality, contributing 50% of PM levels in some regions (Keywood, Hibberd and Emmerson, 2017). The daily maximum concentration standard for $PM_{2.5}$ (25 $\mu g/m^3$, to be reduced to 20 $\mu g/m^3$ in 2025) is frequently exceeded due to bushfires, dust storms and prescribed burns (e.g. in the Northern Territory and Western Australia). Bushfires and

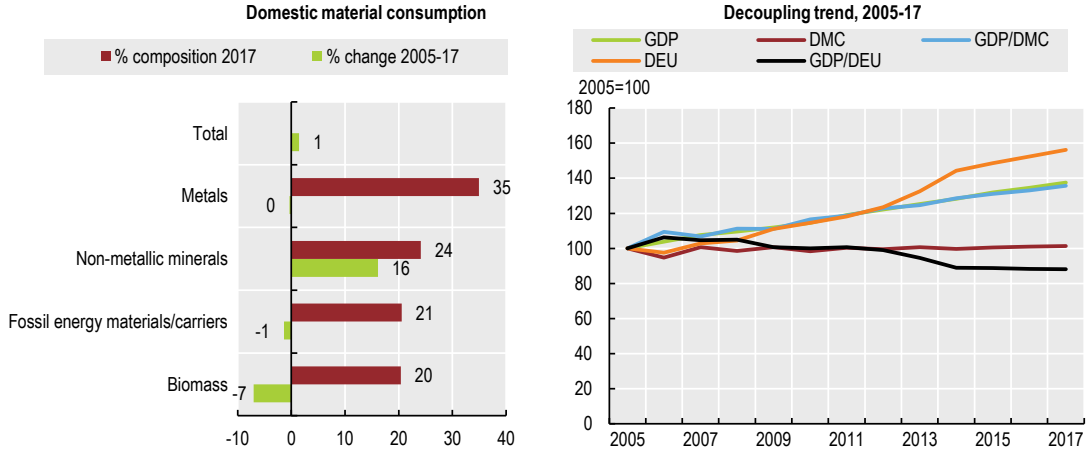
dust storms particularly affected New South Wales's air quality in 2009 and 2013 (EPA of NSW, 2015). Such events are expected to rise with climate change.

1.4. Transition to efficient resource management

1.4.1. Material consumption

Australia is among the most resource-intensive OECD countries in terms of domestic material consumption[7] (DMC) per GDP and per capita, due to high extraction and use of metal ores and fossil energy materials and low population density (Figure 1.8). Resource intensity is even greater when accounting for unused material associated with extraction such as mining overburden, which is particularly high for coal and metals. While DMC remained stable over 2005-17, domestic material extraction of metals and fossil energy materials for export increased faster than GDP.

Figure 1.8. Material extraction increased faster than GDP but consumption remained stable



Note: DMC = domestic material consumption; DEU = domestic extraction used. Material productivity designates the amount of GDP generated per unit of materials used. It refers to the ratio of GDP to DMC, where DMC is the sum of domestic extraction of raw materials used by an economy and the physical trade balance (imports minus exports of raw materials and manufactured products). A rise in material productivity is equivalent to a decline in material intensity (i.e. DMC/GDP). GDP expressed at 2010 prices and purchasing power parities.
Source: OECD (2018), *Material resources* (database); OECD (2018), *OECD National Accounts Statistics* (database).

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1.4.2. Waste management

Main policies and measures

Waste policy is primarily the responsibility of states and territories, with waste services provided by local governments. All states have their own waste management strategies, targets and legislation (Pickin and Randell, 2017). The Commonwealth ensures the country respects international treaties (such as the Basel, Stockholm and Rotterdam conventions), co-ordinates issues affecting multiple jurisdictions and regulates product stewardship (extended producer responsibility) programmes. It also guides waste management through the 2009 National Waste Policy, which sets priorities and objectives but has no measurable targets (Commonwealth of Australia, 2009). As waste is increasingly managed across jurisdictions, there is a need to harmonise reporting, policies and regulations (Chapter 3). Harmonisation should be driven by a Commonwealth

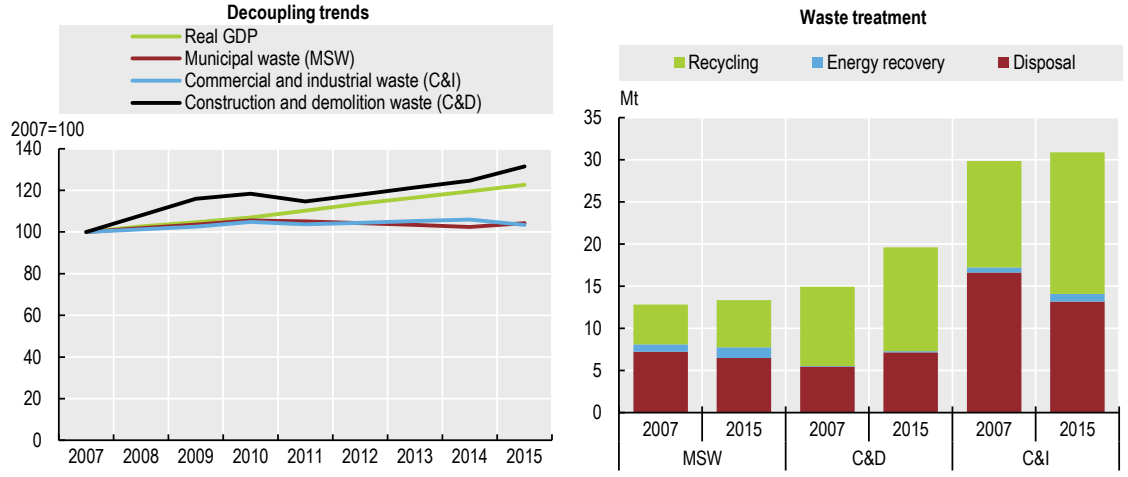
strategy for moving towards a circular economy. These policies contribute to SDG 12 on responsible consumption and production.

Recent decisions by China and other countries to restrict waste imports, combined with challenges related to management of certain waste streams (plastic and paper, coal seam gas, electronics, hazardous waste), represent an opportunity to progress towards a reduce-reuse-recycle hierarchy, strengthen local markets for recycled materials, create local employment and improve the way waste is managed. Australia's environment ministers seized the opportunity to recall and set new targets (e.g. halving food waste by 2030). They also agreed to increase recycling capacity and government demand for recycled products; explore opportunities to advance waste-to-energy and waste-to-biofuels as part of broader policies consistent with the waste hierarchy; quickly develop new product stewardship programmes for photovoltaic solar panels and batteries; and update the 2009 Waste Strategy to include circular economy principles.

Trends

Waste generation slightly increased over the last decade, with construction and demolition waste rising faster than GDP (Figure 1.9). Construction materials, organic waste and fly ash are the main waste streams. The recovery rate (recycling and recovery for energy) increased significantly thanks to increased landfill levies and implementation of national product stewardship programmes (Chapter 3). The recovery rate reached 58% in 2015, with variations across states/territories and streams (from 14% for plastics to 88% for metals). About 7 million tonnes of hazardous waste (both solid and liquid), equivalent to 298 kg per capita, was generated in 2015, and half was recovered (Pickin and Randell, 2017).

Figure 1.9. Waste generation is increasing but more waste is being recycled and recovered



Note: Commercial and industrial waste including fly ash. Disposal mainly refers to landfilling.
Source: OECD (2018), "Municipal waste generation and treatment", *OECD Environment Statistics* (database); Pickin and Randell (2017), *Australian National Waste Report 2016*.

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Municipal waste generation declined to 561 kg per capita but is still higher than the OECD average of 523 kg. A decreasing share of municipal waste is sent to landfill. South Australia leads the way with a recovery rate of 71%, followed by the Australian Capital Territory (64%), while Queensland and Tasmania lag behind at 38%. Policies, income per

capita and urbanisation levels influence waste management (Assessment and Recommendations Figure 2; Pickin and Randell, 2017).

In addition to the need to divert organic waste from landfill, current and emerging challenges for safe waste management include plastic waste accumulation in the ocean, "new" persistent organic pollutants, asbestos (particularly in rural areas), coal seam gas, electronic waste and hazardous waste stockpiling (Pickin and Randell, 2017).

1.4.3. Agriculture

Main policies and measures

Australia's vision for its agricultural sector is outlined in the White Paper on Agriculture Competitiveness (Australian Government, 2015c). It calls for boosting productivity and profitability by improving resource efficiency via investment in R&D, water infrastructure and drought preparation. The government provides support to farmers and landowners to work on improving soil health and better managing erosion and water use through programmes such as the National Landcare Program and best management practices (e.g. in cotton, grazing) (Chapter 4). Over 80% of farmers are involved in Landcare. Farmers and landowners can also contribute to emission reduction activities through Carbon Farming Futures (2012-17) and the Emissions Reduction Fund (Chapter 3). Particular attention is given to helping producers better manage risk via Managing Farm Risk and the Farm Management Deposit Scheme. The Millennium Drought (late 1996 to mid-2010) raised awareness of the impact of climate change. For instance, it was the main driver of local policy development, such as South Australia's Water for Good.

Trends

Australia exports about 60% of its agricultural products and still supplies most of its own food. The agro-food trade balance has remained largely positive over the years. Australia is among the leading world exporters of sheep meat and wool, wheat, sugar, and cotton lint. Agricultural production suffered from the Millennium Drought but has still increased by 5.8% since 2005 (FAO, 2018).

Agriculture's environmental impact is significant. Direct on-farm energy use is rising, and the sector emits 13% of Australia's GHG emissions, including more than half of its methane and nitrous oxide emissions. Agriculture puts considerable pressure on water resources and quality (OECD, 2015b).

The impact of irrigation efficiency projects on return flows – the volume of water that flows back to streams and helps replenish groundwater – is subject to debate (Productivity Commission, 2018). Because there has been no systematic assessment of this impact, some experts have argued that the reduction in recoverable return flows may exceed the amount of water saved – no "real" water has been recovered for the environment through government infrastructure programmes. A recent expert review found that the reduction in return flow was smaller than expected and recommended continued monitoring of return flows from all causes (Wang, 2018). Over 2010-16, irrigated area and water used for irrigation increased, likely due to increased water availability (ABS, 2018a). Water and energy use per unit of agricultural production is higher than it was at the end of the Millennium Drought (1996-2010) (ABS, 2018b).

There is insufficient monitoring of agriculture's impact on water quality and soil erosion (OECD, 2013, 2015c). The nutrient balance is relatively low, but has increased with use of nitrogen fertilisers (up by 55% between 2005 and 2015). Pesticide sales, mostly herbicides and insecticides, have also increased (by 85% between 2005 and 2016) (OECD, 2018e). Much of Australian agriculture is extensive, resulting in a smaller fertiliser and agrochemical footprint than in countries with more intensive agriculture (OECD, 2015b).

Nearly all agricultural land is allocated to permanent pasture (83% in 2016). There is a high share of pastoral farming with low-intensity grazing (cattle and sheep) (OECD, 2015b). Livestock density has remained stable and the activity remains an important source of nutrient pollution. Past overgrazing and land clearing for agriculture put pressure on the environment (e.g. by increasing GHG emissions and accelerating erosion). The area of transgenic crops has more than doubled as has the area under certified organic farm management, which reached 7% of agricultural land in 2016 (nearly twice the OECD average of 4%) (OECD, 2018e).

1.5. Managing the natural asset base

Better management of the natural asset base helps ensure that its benefits can be enjoyed for generations to come. Protecting or using natural resources (land, mineral and fossil resources, forests, biodiversity, water) responsibly and sustainably contributes to global efforts to reach the objectives under the Paris Agreement, the SDGs and the Convention on Biological Diversity.

1.5.1. Physical context and land use

At 7.7 million km^2, Australia is the world's sixth largest country and makes up 6% of its land mass. Agriculture, mainly grazing, accounts for about half the land area. Australians live mostly on the eastern, southeastern and southwestern coasts in dense urban areas, often close to industry and intensive agricultural activities. Urban areas have become much denser in recent decades, with their land area growing much more slowly than the urban population (OECD, 2018f).

Primary responsibility for land use planning regulation and legislation, which needs to respect the Environment Protection and Biodiversity Conservation (EPBC) Act, lies with state and territory governments. Competing for land use are agriculture, resource industries, urban development and native habitat conservation. Land use has been shaped by European settlement patterns, water availability, soil types and climate (Metcalfe and Bui, 2017).

The native vegetation is highly diverse and supports ecosystem services such as stabilising soil and creating animal habitats. The current level of loss, however, seriously affects soil condition. Fire, land clearing, current and past grazing and harvesting are the main pressures on vegetation. They are driven by agriculture and forestry, resource extraction and urbanisation, and indirectly by climate change. The 2012 Native Vegetation Framework calls for improving native vegetation management and introduces goals and measurable targets.

Soil degradation affects the capacity to produce food and fibre, protect biodiversity and ensure resilience to climate change. Wind and water erosion and soil acidification threaten soil quality. Widespread soil acidification in the south (especially in Western Australia's wheat belt and in intensive land use systems) remains an issue

(OECD, 2015b). A rapid increase in agricultural land under conservation tillage has helped reduce erosion (OECD, 2013).

1.5.2. Biodiversity and ecosystems

Forests

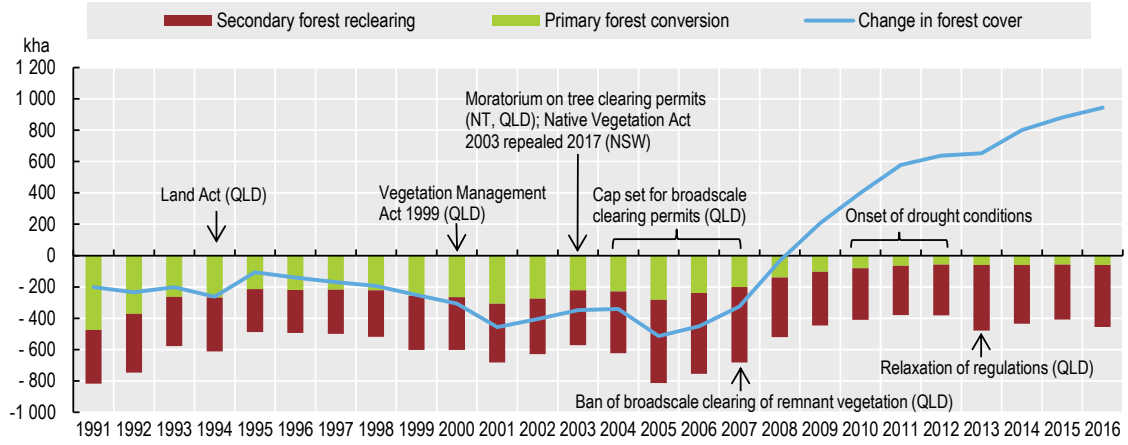
In 2015, Australia's forests covered 125 million ha, equivalent to 16% of the land area and 3% of global forest area. Forests are mainly located in Queensland (41%) and New South Wales (18%). Nearly all (98%) of the area is covered by native forests, mainly eucalyptus and acacia. A majority (67%) of the forest area is privately owned or managed and 18% is allocated to conservation and recreation (ABARES, 2016).

Over the past decade, forest regrowth more than offset losses from clearing, resulting in increased forest cover (Figure 1.10). However, deforestation, chiefly re-clearing, has increased since 2012. Clearing of primary forest continues, driven by agriculture and mining as well as urban expansion. Tree clearing has other effects, which are not accounted for, on biodiversity, soil values and carbon stocks, and can disrupt Indigenous land management practices (Chapter 4). Most deforestation takes place in Queensland (Metcalfe and Bui, 2017).

Queensland's woody vegetation[8] clearing rate increased by 33% between 2014/15 and 2015/16. Almost 400 000 ha was cleared in 2015/16, the highest level of clearing since 2003/04. Some 40% of Queensland's woody vegetation clearing occurred in Great Barrier Reef catchments, where the clearing rate rose by 45% in a year (DSITI, 2017). A weakening of land clearing laws in New South Wales and Queensland brought a resurgence of forest clearing, mainly for livestock farming (Figure 1.10). However, the 2018 Vegetation Management and Other Legislation Amendment Act (Queensland) reinstated a number of vegetation management controls that were repealed in 2013 to protect high-value regrowth vegetation and vegetation in reef catchments.

Despite its large forests, Australia is a net importer of wood and wood products (Australian Government, 2013). The National Forest Policy Statement, which has guided forest management since 1992, provides a vision for the sector and since 1998 has required all states to report every five years on the state of their forests (Australian Government, 1992).

Figure 1.10. Forest regrowth more than offsets losses from clearing



Notes: The list of policies and events that have influenced trends in tree clearing is not exhaustive. Primary forest conversion refers to the conversion of mature primary forest to cropland and grassland, and secondary forest reclearing refers to clearing of forest that had re-grown on previously cleared land.
Source: DEE (2018), *National Inventory Report 2016 - Volume 2*; Simmons and al. (2018), *Spatial and temporal patterns of land clearing during policy change*

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Species

Australia is estimated to have over 500 000 species (Chapman, 2009) and is one of the world's 17 megadiverse countries. Having developed in isolation, its rich biodiversity has a high level of endemic species. The 1999 EPBC Act provides the legal framework for biodiversity conservation. It requires identification and monitoring of biodiversity, threatened species and ecological communities, migratory species and marine species. The act identifies 21 key threat processes that can pave the way to threat abatement plans, such as land clearing (e.g. threat to bird species on grassland habitats), habitat fragmentation and degradation, invasive species and climate change (Cresswell and Murphy, 2017). The 2015 Threatened Species Strategy identified high-priority actions for addressing these threats (Commonwealth of Australia, 2016). It is aligned with Australia's Biodiversity Conservation Strategy (2010-30), which contains national targets for increasing conservation activities, area and employment, and participation of Indigenous peoples in biodiversity conservation, and requires long-term biodiversity monitoring and reporting (Commonwealth of Australia, 2010a; Chapter 4).

The number of nationally listed threatened species has grown since the act's introduction. In 2018, it listed 511 fauna species, categorising them as critically endangered (78), endangered (163), vulnerable (207), conservation dependent (8) or extinct (55). The act also lists over 1 300 threatened flora species (Chapter 4).

Protected areas

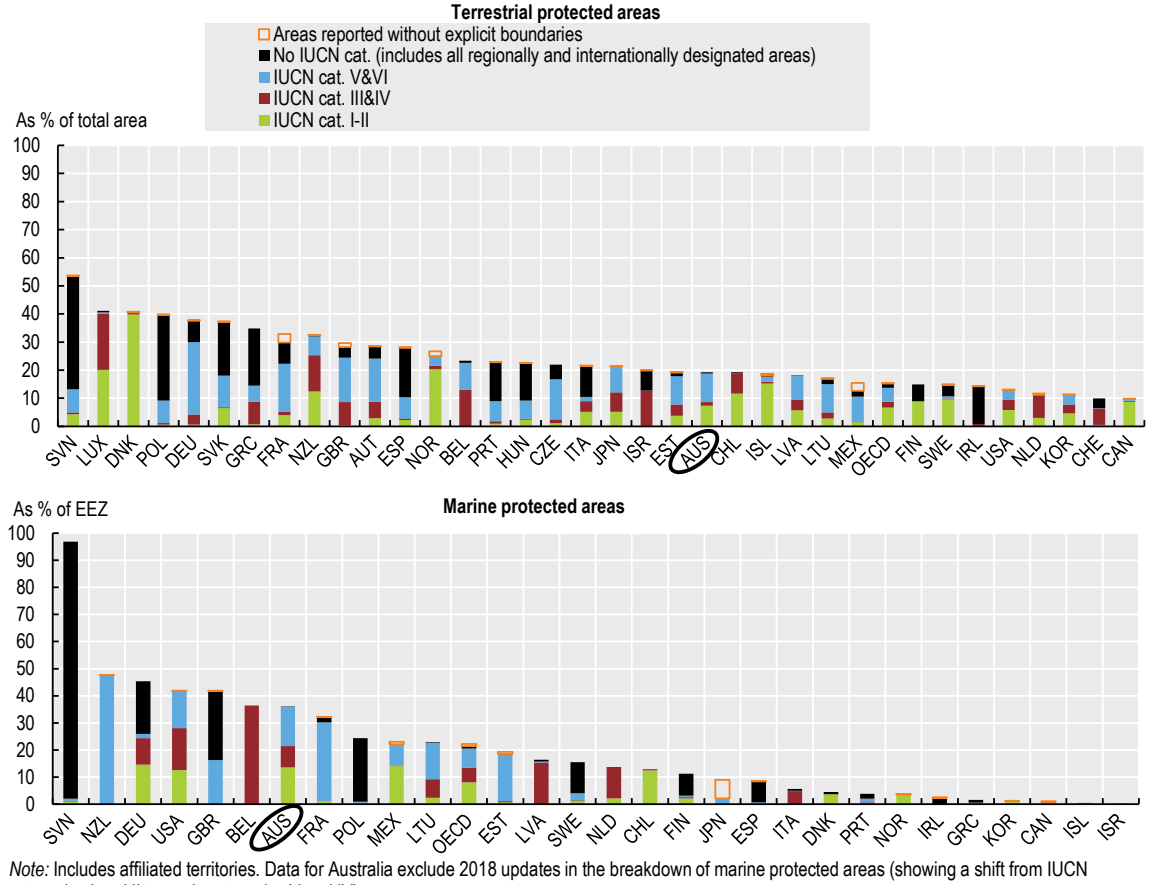
The National Reserve System (NRS) is Australia's network of land and inland freshwater protected areas. It is guided by the NRS Strategy 2009-30, which identifies actions and sets targets for ensuring long-term biodiversity protection. The strategy is translated at the state/territory level with five-year implementation plans (Commonwealth of Australia, 2010b; Chapter 4).

The NRS covers about 20% of Australia's land, mainly in Western Australia (39% of NRS), the Northern Territory (22%) and South Australia (20%) (Assessment and

Recommendations Figure 2). The share of land it covers grew by 7 percentage points between 2008 and 2016, mainly due to an increase in the number of Indigenous Protected Areas. Indigenous Protected Areas cover nearly half (45%) of the NRS. The rest is either jointly or privately managed by the Australian Government, the states, territories, local government, Indigenous and private landholders and non-government organisations (DEE, 2016).

The Convention on Biological Diversity set a target of conserving at least 17% of terrestrial and inland water and 10% of coastal and marine areas (especially areas of particular importance for biodiversity and ecosystem services) through protected areas and other area-based measures. As defined by the International Union for Conservation of Nature (IUCN), about 19% of Australia's territory is protected, above the OECD average of 15%. About half is designated in IUCN management categories I-IV, the other half being in categories V-VI (Figure 1.11).

Figure 1.11. Australia protects a higher share of its land and marine area than the OECD as a whole



Note: Includes affiliated territories. Data for Australia exclude 2018 updates in the breakdown of marine protected areas (showing a shift from IUCN categories I and II towards categories V and IV).
Source: OECD (2018), "Biodiversity: Protected areas", *OECD Environment Statistics* (database).

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Australia is among the countries with the largest exclusive economic zones (EEZs), which are important for commercial fisheries, aquaculture and tourism. Its biodiversity-

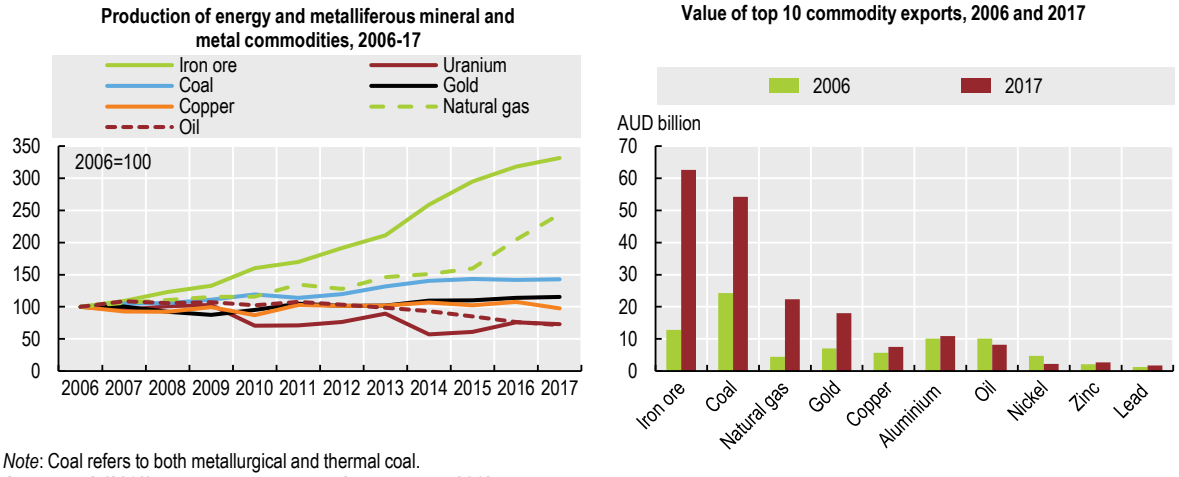
rich marine areas, however, are exposed to pressures from economic activities (commercial fishing as well as oil and gas exploration) and from climate extremes leading to coral bleaching and habitat destruction. Marine protected areas cover a surface of 36% of EEZ waters, well above the OECD average (Chapter 4).

1.5.3. Fossil fuel and mineral resources

Australia is endowed with a wide variety and significant quantities of natural resources, including both minerals and energy resources. The 2017-22 National Mineral Exploration Strategy aims to further support the mineral resource industries (Geoscience Australia, 2017a). The most important export resource is iron ore, of which 83% goes to China (Figure 1.12). Australia is home to more than 15% of the world's production of metallurgical coal, which is exported mainly to India and China for steel-making. The world's third largest uranium producer, Australia holds almost one-third of total proven reserves. It ranks as the second largest gold producer and top alumina exporter, and also has aluminium, copper, nickel and zinc resources (DIIS, 2018). While many resources could potentially last more than 40 years (e.g. bauxite, black coal, copper, lead, silver, uranium and zinc), others, such as iron ore and gold, may last only about 20 years at 2016 production rates (Geoscience Australia, 2017b). Australia has significant resource potential in essential commodities for low-emission energy production and use, such as lithium, graphite and rare earth elements (Skirrow et al., 2013).

Regarding fossil fuels, Australia is the world's second largest thermal coal exporter, selling mainly to Japan, China and Korea. Coal deposits and mines are located in New South Wales, Queensland and Victoria. Since the last review, LNG exports have risen sharply. With volume and value of LNG exports rising, Australia is on track to become the world's largest LNG exporter. LNG projects and gas basins are mainly located in the north. Oil production has been declining since 2011 (Figure 1.12).

Figure 1.12. Australia has a rich variety of mineral and fossil fuel resources



Note: Coal refers to both metallurgical and thermal coal.
Source: DIIS (2018), *Resources and Energy Quarterly June 2018*.

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1.5.4. Water resource management

States and territories are responsible for water resource management within their jurisdictions (Chapter 2). The overarching framework is the 2004 National Water Initiative (NWI), which aims to increase efficiency with the support of market reforms, regulations and planning (Argent, 2017). Nationally consistent water policy was strengthened in 2007 with the Water Act, one objective of which is to protect the environmental and economic value of surface waters and groundwater in the Murray-Darling Basin (MDB) via the 2012 Basin Plan for surface waters and groundwater. These measures contribute to SDG 6 on ensuring water and sanitation for all.

Progress has been made under the NWI (Table 1.1). However, scope for improvement remains on water access entitlements and planning (e.g. Northern Territory and Western Australia have yet to introduce statutory-based water rights), on water pricing (Chapter 3) and on Indigenous community engagement (e.g. Western Australia is yet to establish specific mechanisms for engaging Indigenous people) (Productivity Commission, 2017).

Table 1.1. The National Water Initiative is progressing but there is scope for improvement

	Progress towards commitments under the National Water Initiative
Water access entitlements and planning frameworks	• All jurisdictions (except NT and WA) have created statutory-based, clear and secure long-term water rights for consumptive uses. In some areas, major water uses (e.g. by extractive industries) are not yet part of the allocation framework. • Water planning arrangements have been established for the majority of areas of intensive water use. Most jurisdictions have more than 80% of water use managed under water plans. This means the sharing of water resources between consumptive uses and the environment has been established in consultative processes, informed by scientific and other assessments.
Water markets and trading	• Water markets have been established that have allowed water to be traded to higher-value uses and other steps have been taken to improve the efficiency of water markets, most notably in the MDB.
Best practice water pricing and institutional arrangements	• Urban service providers are generally pricing at the levels required by the NWI, despite some instances of underpricing. • Independent economic regulators set prices or revenue for major urban water suppliers (ACT, NSW, SA, TAS and VIC). NT, QLD, WA and regional NSW are exceptions in various forms. • Cost-reflective pricing outcomes are generally being achieved for most existing irrigation infrastructure, but new irrigation infrastructure has tended to be underpriced. QLD, TAS and WA could make better use of economic regulation. • There is inconsistent recovery of water planning and management costs from users across Australia.
Integrated water management for environmental and other public benefit outcomes	• Environmental sustainability has been supported by formal provisions of water for the environment and progress has been made on rebalancing over-allocated systems. • All jurisdictions have managers with responsibility for environmental flows, and some arrangements are in place to co-ordinate water use in shared resources.
Water resource accounting	• Water metering, accounting and compliance systems are in place in all jurisdictions. However, some water take remains unmetered and compliance issues are challenging accurate water accounts.
Urban water reform	• Water reuse, water use efficiency, water sensitive urban design and innovation have improved with the NWI. • Jurisdictions have taken action to address water quality issues, with some evidence of success.
Knowledge and capacity building	• There have been advances in knowledge and capacity across areas identified in the NWI.
Community partnerships and adjustment	• All jurisdictions have set in legislation, or policy, minimum requirements for stakeholder engagement and consultation when developing and reviewing water plans. • State and territory governments have delivered improved decision making through open and timely consultation with stakeholders. This has been supported by the publication of supporting information at key decision points.

Source: Productivity Commission (2017), *National Water Reform*.

While the NWI has achieved important gains, contemporary issues are emerging. Water use in extractive industries and from alternative sources (recycled water, storm water)

should be incorporated in entitlements and planning frameworks. Water needs for Indigenous economic development should be better recognised. Water planning needs to better integrate the impact of climate change, which is expected to be significant. It will be important to recommit to the 2004 NWI, in light of current and future challenges (Productivity Commission, 2017).

Water resources

Australia is the world's driest inhabited continent. Highly variable climate patterns with recurrent drought and flooding have led the country to build considerable storage capacity. Although water stress at the national level is below the OECD average, water resources, use and quality vary widely geographically (Figure 1.13). Surface water resources are concentrated around the coastal rim. Most water use occurs in the southeast and southwest, where the majority of the population resides and where major irrigation systems are located (Productivity Commission, 2017).

Meeting demand from a rapidly increasing population in southern Australia, where precipitation is projected to decline further, will be a challenge. Australia is looking into supply options, including both centralised infrastructure such as dams and desalination plants and localised wastewater reuse and storm-water harvesting to prepare for future water management (Productivity Commission, 2017).

Figure 1.13. State and trends of water resources and quality by drainage division

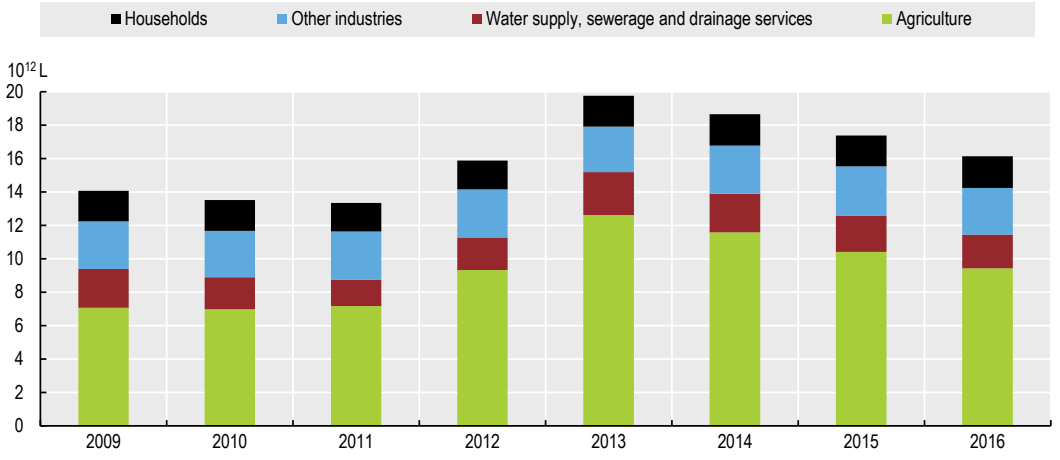
Source: Argent (2017), *Australia state of the environment 2016: inland water*.

After a decade of reduced water use triggered by the 1996-2010 Millennium Drought, water use increased sharply between 2011 and 2013 before decreasing again (Figure 1.14). This trend was mainly driven by agriculture, particularly in the MDB and

favourable rainfall conditions over 2010-12. Pasture for grazing and cotton and sugar production are the main agricultural water users. Household water use has increased since 2010, broadly in line with population growth (ABS, 2017).

Jurisdictions are applying mechanisms to recover water for the environment in overused water systems (Chapter 3). In the MDB, about 20% of water entitlements are managed for the environment, with some evidence of positive outcomes. However, reaching the recovery target will be a challenge (Productivity Commission, 2018). Water for the environment needs to be efficiently managed to achieve the best outcomes, as water for the environment is not necessarily sufficient to improve aquatic ecosystem health (Chapter 4). Jurisdictions need to ensure that local environmental flow management and environmental objectives (e.g. on water quality, habitat and pest management) are coherent across complementary waterways. Finally, monitoring, evaluation, auditing and reporting are key to demonstrating the benefit of allocating water to the environment, strengthening trust and ensuring accountability (Productivity Commission, 2017).

Figure 1.14. Agriculture is the main water user



Note: Agricultural consumption includes self and collective water supply.
Source: ABS (2017), *Water Account, Australia, 2015-16* (database).

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Water quality

Water quality targets and activities are the responsibility of states and territories, with support and co-ordination from national leadership. For example, the National Water Quality Management Strategy provides water quality management guidelines used by jurisdictions to develop their own regulations, policies and targets. Healthy water management plans (in Queensland) and water quality improvement plans, developed with regional natural resource management bodies with local government support, also define actions at the local level.

Monitoring by states and territories shows that most drainage divisions are in either poor or very poor condition and only a few have seen their situation improve (Figure 1.13). There is no comprehensive regular countrywide assessment of water quality. As part of its national role in water information, the Bureau of Meteorology is investigating continual provision of water quality data on the web (Argent, 2017).

Agriculture remains a major source of diffuse pollution (Section 1.4.3). Over-abstraction and lower rainfall have reduced water bodies' dilution capacity and exacerbated the problem of water pollution, which is likely to increase with climate change. The MDB Plan and Basin Salinity Management Strategy 2030 aim to address these issues. Salinity targets have been met for most areas. Coastal waters downstream of large agricultural areas, such as the Great Barrier Reef, are affected by sediment, nutrient and pesticide loading (OECD, 2013; Waterhouse et al., 2017; Chapter 4; Box 1.2). Toxins, pathogens and excess nutrients from agriculture, industry and urban runoff flow into catchments, affecting marine and coastal water quality.

Discharges from municipal treatment plants and industrial facilities are the main types of point-source pollution, although point sources no longer significantly affect the water environment (Argent, 2017). Developing coal seam gas and large coal mining reserves can also affect surface waters and groundwater, both in quantity and quality. Australia last reported to the OECD on its share of resident population connected to urban wastewater in 2004, when 13% were not connected to public sewerage or relied on independent treatment systems (OECD, 2017f).

The rivers of the MDB are generally in poorer condition than coastal rivers, with local disturbances in some catchments, due to altered flows. Bathing water quality is higher at ocean beaches than in inland waters (EPA of NSW, 2015). In Victoria, land clearing and bushfires have changed vegetation cover and accelerated runoff and erosion, increasing sedimentation, nutrient pollution and algal blooms (Commissioner for Environmental Sustainability, 2013). Queensland's catchments are affected by sediments, nutrients and pesticides (Department of Environment and Heritage Protection, 2016).

The National Water Quality Management Strategy includes drinking water guidelines (2011, 2016) setting microbiological, chemical and aesthetic standards for drinking water. Good progress has been made in delivering safe drinking water to urban areas. Most utilities, with a few exceptions in regional and remote areas, achieve full compliance with the standards (BOM, 2017).

Box 1.2. Improved agricultural practices are needed to meet water quality targets in the Great Barrier Reef

The Great Barrier Reef is threatened by climate change and diffuse pollution from land use activities. Poor water quality has resulted from nutrients, sediment, pesticides and other pollutants in land-based runoff, which affects the health and resilience of the Great Barrier Reef ecosystems, including coral, seagrass and wetland habitats. Pollution from agricultural runoff, identified as a critical issue in the 1990s, is being addressed through measures such as:

- The Reef 2050 Water Quality Improvement Plan (2017-22) (updating the Reef Water Quality Protection Plan), which sets targets for improving water quality and land management practices upstream (e.g. reducing loads of pesticides, sediments and nutrients). Better targeting of investment is resulting in less pollution flowing to the reef. Faster uptake of improved land management practices for grazing, sugar cane and grain crops, and horticulture is required to meet targets.
- The Reef 2050 Long-Term Sustainability Plan aims to improve water quality, ecosystem health, biodiversity, and Indigenous and non-Indigenous heritage, and to accelerate community and economic benefits (Chapter 4).

Despite recent efforts to reduce pollutant runoff from land-based activities, progress towards meeting the water quality targets set to improve the health and resilience of the Great Barrier Reef has been slow, and the present trajectory suggests the targets will not be met. Greater effort to improve water quality is urgently required to progress towards substantial pollutant reductions using an expanded range of tailored and innovative solutions.

Source: OECD (2017g), *Marine Protected Areas: Economics, Management and Effective Policy Mixes;* Kroon, F. et al. (2016), "Towards protecting the Great Barrier Reef from land-based pollution", *Global Change Biology*; Australian and Queensland Governments (2017), *Results: Great Barrier Reef Report Card 2016 – Reef Water Quality Protection Plan*; Waterhouse et al. (2017), *Scientific Consensus Statement: Land Use Impacts On Great Barrier Reef Water Quality And Ecosystem Condition.*

Notes

[1] Expressed in tonne-kilometres.

[2] Of total passenger transport expressed in passenger-kilometres.

[3] The profile of electricity emissions varied over 2005-17. Emissions rose over 2005-09 then decreased until 2014. After the carbon pricing mechanism was removed in 2014, emissions increased until 2016 before decreasing in 2017 with the closure of Hazelwood, Australia's most emission-intensive power station.

[4] Shares calculated on total GHG excluding LULUCF, while national shares include LULUCF.

[5] Australia negotiated Article 3.7 of the Kyoto Protocol, which allows nations for which LULUCF was a net source of emissions in 1990 to add these emissions to their base-year calculations.

[6] Australia had pledged in 2012 to increase its 2020 pledge to 15% from 2000 levels by 2020 if there was a global agreement implying atmospheric stabilisation at between 510 and 540 parts per million (ppm) CO_2e and to 25% if the world agreed to an ambitious global deal capable of stabilising levels of GHG in the atmosphere at 450 ppm CO_2e or lower. The concentration of CO_2e in the atmosphere that the world must stay at or under to stay true to the 2°C goal, as agreed in the Paris Agreement, is 450 ppm.

[7] Sum of domestic raw material extraction used by an economy and its physical trade balance (imports minus exports of domestic raw materials and manufactured products).

[8] Woody vegetation refers to native vegetation, disturbed areas of native vegetation, regrowth, plantations of native and exotic species, some woody weeds and urban woody vegetation.

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Annex 1.B. Examples of environmental policies

	Air	Climate change adaptation	Climate change mitigation	Water	Waste	Biodiversity
Relevance to SDGs	SDG 3; SDG 13	SDG 13	SDG 7; SDG 13	SDG 6	SDG 12	SDG 14; SDG 15
AUS	National Clean Air Agreement	National Climate Resilience and Adaptation Strategy 2015		National Water Initiative 2004; National Water Quality Management Strategy; National Groundwater Strategic Framework; MDB Plan	National Waste Policy 2009; National Food Waste Strategy	Threatened Species Strategy; Biodiversity Conservation Strategy 2010-30; Strategy for the National Reserve System 2009-30; Pest Animal Strategy; Weeds Strategy
ACT		Adaptation Strategy 2016-20	Climate Change Action Plan 2012	Water Strategy 2014-44	Waste Management Strategy 2011- 25	ACT Nature Conservation Strategy 2013-23
NSW	Clean Air for NSW; Diesel and Marine Emissions Management Strategy 2015; Managing Particles and Improving Air Quality in NSW 2013	Climate Change Policy Framework 2016; NSW Coastal Management Framework	Climate Change Policy Framework 2016; NSW Energy Efficiency 2013	Water Conservation Strategy 2017 Metropolitan Water Plan; Water Reform Action Plan	Waste Avoidance and Resource Recovery Strategy 2014-21	Biodiversity Conservation Investment Strategy 2018; Draft National Parks System Directions Statement
NT		Climate Change Policy 2009	Roadmap to Renewable Energy		Waste Management Strategy 2015-22	
QLD		QLD Climate Adaptation Strategy	QLD Climate Transition Strategy	Water Planning Framework; Reef 2050 Water Quality Improvement Plan	Waste Avoidance and Resource Productivity Strategy 2014- 24	Reef 2050 Long-Term Sustainability Plan
SA		Climate Change Adaptation Action Plan 2018; Regional Climate Change Adaptation Plans	Climate Change Strategy 2015-20	Water for Good	Waste Strategy 2015-20; Environment Protection (Waste to Resources) Policy 2010	Species Strategy 2007
TAS	Air Quality Strategy 2006; Environment Protection Policy	Climate Change Action Plan 2017-21	Climate Change Action Plan 2017-21	Water Quality Management; State Policy on Water Quality Management 1997	Waste and Resource Management 2009	Natural Heritage Strategy 2013-30
VIC	State Environment Protection Policy (Ambient Air Quality) and State Environment Protection Policy (Air Quality Management)	Climate Change Adaptation Plan 2017-20; Renewable Energy Action Plan; Energy Efficiency and Productivity Strategy	Climate Change Framework 2016	Waterway Management Strategy 2013 Water for Victoria 2016	Statewide Waste and Resource Recovery Infrastructure Plan 2018	Biodiversity 2037; Living with Wildlife Action Plan 2018
WA		Adapting to our Changing Climate 2012			Waste Strategy 2012