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Executive summary

Achieving net zero emissions will entail a major reorientation of global trade and investment. As the world progresses towards net zero emissions, governments, investors and consumers will increasingly favour lower emissions products. Decisions in one part of the world will reverberate along global supply chains right back to Australia, posing both challenges and opportunities for our emissions intensive economy. Trade and investment are the ties that bind private enterprise, governments and nations together in the decarbonisation journey.

The private sector has begun limiting finance for fossil fuel projects—particularly thermal coal—and sustainable finance is growing, albeit off a low base. On a decarbonisation trajectory consistent with the Paris Agreement, global low carbon investment would more than triple on current levels, to average US\$2.4 trillion a year over the next 30 years. Over the same period, fossil fuel investment would almost halve to US\$580 billion a year.

The global financial system is being regeared to manage climate risk. Major economies are moving to require businesses to disclose their exposure to climate-related financial risks, and defining what constitutes a sustainable investment. Australia will need to show that investment opportunities are consistent with a Paris-aligned decarbonisation trajectory to attract global capital.

Trade policy is also emerging as a vehicle for climate action. The world's largest economies, including some of Australia's key trading partners, are considering using trade to drive global decarbonisation, including measures such as carbon border adjustment mechanisms. These actions by governments add to the growing push from markets and consumers for companies to disclose their supply chain emissions and certify the carbon content of their products.

Trade and investment measures are joining the Paris Agreement in the fast growing 'Paris Plus' institutional architecture of rules and norms to drive global decarbonisation. The Paris Plus architecture includes subnational and corporate targets, climate-related financial disclosure, carbon market mechanisms, taxonomies and certification schemes, investor and consumer decisions, climate-related litigation, potential carbon border measures and more.

Whereas competition in global markets has historically rested on factors such as the relative costs of production, quality, and security of supply, as the world shifts towards net zero emissions carbon content will become increasingly important for competitive advantage. We will need to produce the cleanest exports at the lowest cost to succeed in overseas markets. Accelerating emissions reductions will ensure that we play our part in the global response to climate change *and* position the Australian economy to prosper.

The good news is that Australia has some of the world's best renewable resources, extensive landscapes conducive to sequestration of carbon, and large reserves of the raw materials required for low emissions technologies, such as lithium, uranium, nickel and copper. We also have the potential to decarbonise exports with high embedded emissions, such as steel, aluminium and beef. A global increase in demand for lower emissions products and services has the potential to open up new areas of jobs and growth in Australia in diverse economic sectors such as sustainable agriculture, new clean-tech industries and environmental and financial services.

The new and evolving rules of low emissions trade and investment will also impact our international competitiveness. Countries that are active in shaping the future rules of low carbon trade are likely to gain a competitive advantage. It is in Australia's interest to be deeply embedded in international climate change rule making.

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Introduction

The recent Intergovernmental Panel on Climate Change report on the physical science basis of climate change points to an urgent need to reach net zero emissions by mid-century in order to hold warming to 1.5°C (IPCC 2021). Global action to rapidly reduce emissions in line with this target would have profound implications for the world energy system. The International Energy Agency (IEA) report, *Net Zero by 2050—A Roadmap for the Global Energy Sector*, highlights the transformation in the world's energy mix required to support the achievement of global net zero emissions (IEA 2021a). According to the IEA, “nothing short of a total transformation of the energy systems that underpin our economies” is required.

The pathway to net zero by 2050 identified by the IEA as the most technically feasible, cost effective and socially acceptable includes:

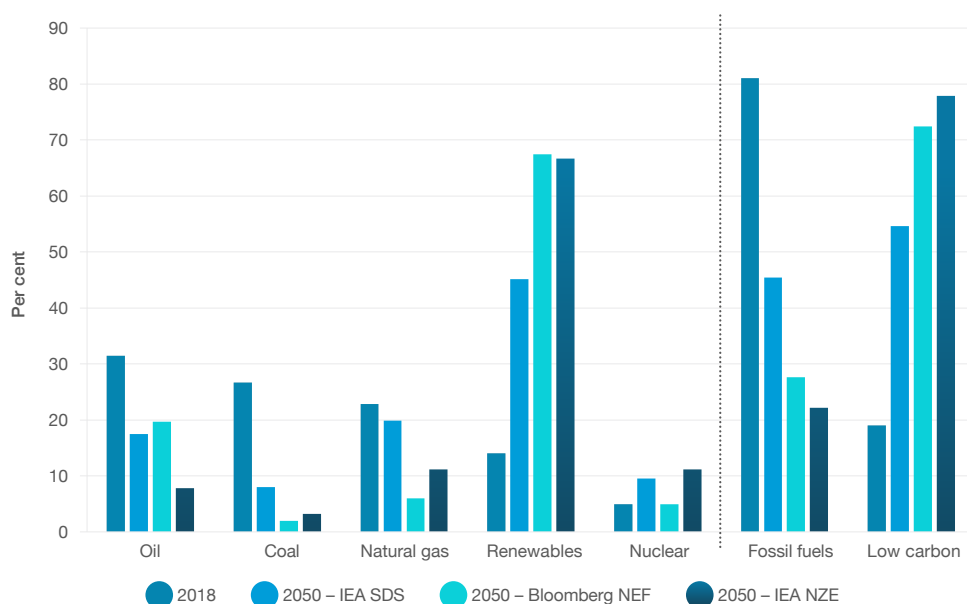
- A major decline in the share of fossil fuels in the global energy mix, from almost 80 per cent in 2020 to just over 20 per cent in 2050.
 - A rapid drop in fossil fuel demand means that no new oil and natural gas fields are required beyond those already committed for development as of 2021, and no new coal mines or mine extensions are required.
- Renewable sources supplying almost 90 per cent of electricity generation by 2050. However, fossil fuel use does not end overnight—accounting for more than half of total energy supply in 2030 and over a third in 2040.
- All remaining fossil fuel use in 2050 being paired with carbon capture, use and storage, embedded in products (such as plastics) or offset by negative emissions technologies.

The IEA's Net Zero by 2050 Scenario (IEA 2021b) is not the only scenario under which the goals of the Paris Agreement can be achieved. Figure 1 compares the IEA's Net Zero by 2050 Scenario with two other decarbonisation scenarios consistent with global warming being held to below 2°C.

As the urgency of tackling climate change becomes clearer, a new 'Paris Plus' global climate architecture is emerging. The Climate Change Authority has coined the term Paris Plus to describe global actions—not only by governments but by buyers, sellers and investors as well—that implement and complement the 2015 agreement. The Paris Plus architecture includes the numerous market mechanisms, agreements, corporate targets and behaviours that drive action on climate change.

Trade and investment are the transmission mechanisms through which global decarbonisation efforts will impact Australia. Carbon border adjustment mechanisms (CBAMs), emissions certification schemes, new investment taxonomies and other such arrangements are reshaping the international trade and investment landscape. These developments will invariably reverberate along global supply chains and impact Australia's economy.

Figure 1: World energy mix in 2018 and in 2050 under scenarios consistent with the Paris Agreement



Source: IEA 2019b; BloombergNEF 2020; IEA 2021a.

Notes: Total primary energy demand; IEA Sustainable Development Scenario (SDS); BloombergNEF NEO Climate Scenario 2020; IEA Net-Zero by 2050 Scenario (NZE). These scenarios are described in Table 1.7.

Investment

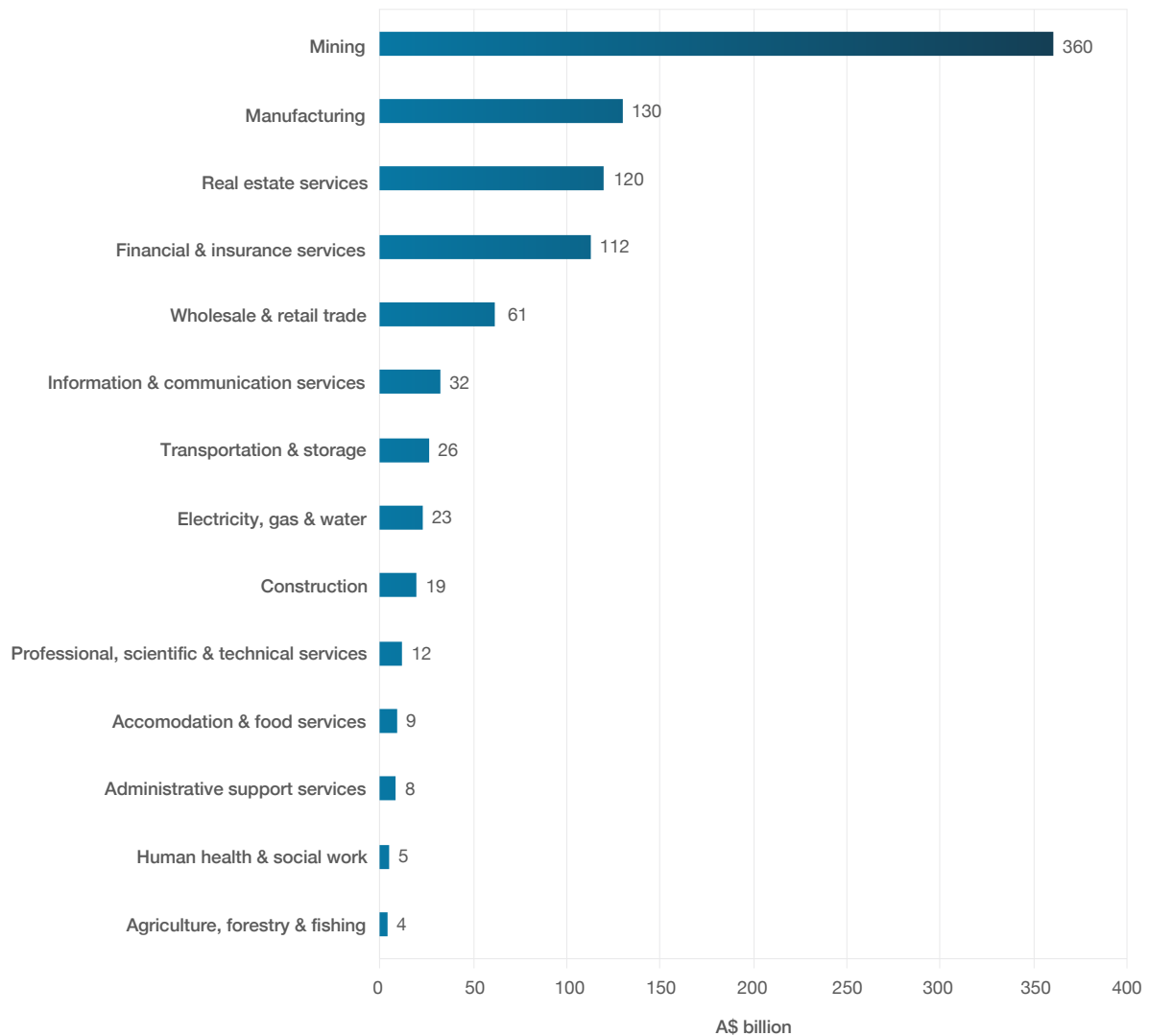
As a net recipient of foreign investment, global capital flows matter to Australia. In 2020, inward foreign direct investment (FDI) was equal to just over 50 per cent of Gross Domestic Product (GDP) (ABS 2021a; ABS 2021b)—above the G20 average of 37 per cent and slightly below the Organisation for Economic Co-operation and Development (OECD) average of 56 per cent of GDP (OECD 2020).

Foreign investment provides the capital required to finance new industries and expand existing ones, boosting economic growth and creating employment opportunities in the process (DFAT n.d.). It also brings ‘spillover’ benefits. For example, multinational companies operating in Australia bring new technologies, technical know-how, management expertise and networks that filter through to the rest of the economy (Productivity Commission 2020). Foreign investment can provide Australian businesses with access to new markets, and increased competition in the domestic market can drive innovation and economic growth (DFAT n.d.).

Australia’s inward stock of FDI totalled over A\$1 trillion at the end of 2020 (ABS 2021a). To put this number in context, the value of physical assets in the Australian economy (excluding housing) is estimated to be around A\$6 trillion (Productivity Commission 2020). The mining sector is by far the largest recipient of FDI in Australia, attracting more than twice the amount of FDI than the next largest recipient sector (Figure 2). Australia’s largest export industries—iron ore, coal and natural gas—tend to dominate investment flows into mining (DISER 2020b).

Australia’s top ten sources of FDI are (in order) the United States, the European Union, the United Kingdom, Japan, Hong Kong, Singapore, China, New Zealand, Canada and Switzerland. Of these, Singapore is the only country without a target to reach net zero emission by 2050 or 2060 (Part 1, Table 1.1). Several of these countries are also using sustainable finance policies to channel investment towards low carbon activities (Appendix 1, Table A1.2). Attracting low carbon investment flows from these countries will be essential for Australia to be able to build the industries required to drive economic growth in a net zero world.

Introduction

Figure 2: Foreign direct investment in Australia by industry, 2020

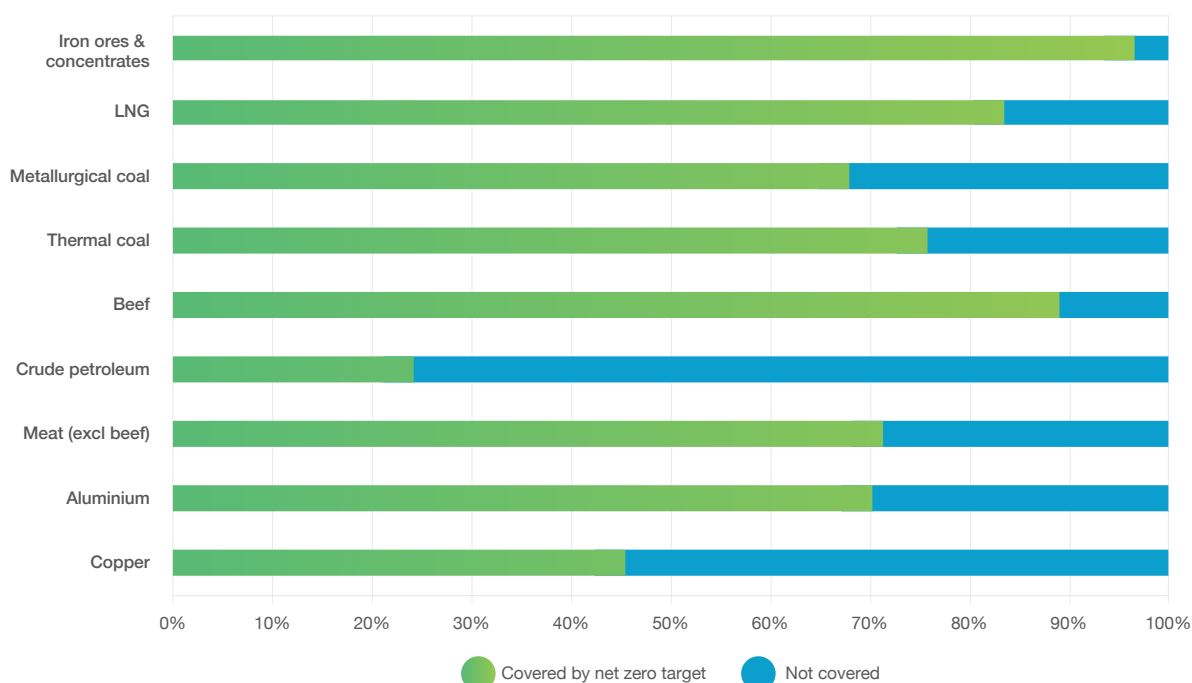
Source: ABS 2021a.

Notes: Manufacturing data not available for 2020. 2019 data shown for illustrative purposes.

Trade

Trade is the second way in which global decarbonisation efforts will transmit back to Australia's economy. Access to export markets is central to Australia's economy, providing Australian businesses with an opportunity to expand into new and larger markets. In 2019–20, the value of Australia's two way trade was 44 per cent of its GDP, and exports stood at 24 per cent of GDP (ABS 2020). Figure 3 shows the percentage of selected Australian commodities exported to countries with net zero targets. Seven of Australia's top 10 trading partners have mid-century net zero emissions targets—accounting for 68 per cent of Australia's two way trade.

Figure 3: Percentage of selected Australian exports covered by mid-century net zero targets, 2019–20



Source: DFAT 2020a; DISER 2020c; Energy & Climate Intelligence Unit 2021; ClimateWatch 2021; CCA analysis of recent net zero commitments.

Notes: This analysis includes national targets to achieve net zero emissions by 2060 or earlier, where they are legislated or proposed in legislation, in a policy document, or in a high-level political pledge. Targets under consideration and not yet formalised are not included. The extent to which current policy architecture supports the achievement of mid-century net zero targets varies from country to country.

This paper explores the emerging trends in international trade and investment as the world increasingly responds to the challenge of achieving net zero emissions. It lays the groundwork for a discussion about a prosperous Australian economy in a decarbonising world.

Part 1 provides an overview of trends in low carbon investment and finance, analyses the key drivers of these trends, and outlines the likely future trajectory of capital flows in a global low emissions economy.

Part 2 examines the emerging trends in international trade policy, the possible emergence of CBAMs, existing and emerging emissions certification schemes, and the inclusion of climate considerations in trade agreements.

Part 3 identifies the challenges and opportunities that global net zero trade and investment trends present for Australia.

Part 1: Investment and finance

Key findings

Achieving net zero emissions will entail a major reorientation in global investment. On a decarbonisation trajectory consistent with the Paris Agreement, global low carbon investment would more than triple on current levels to average US\$2.4 trillion a year over the next 30 years. Over the same period, fossil fuel investment would almost halve to US\$580 billion a year.¹ The economics of energy markets will drive significant growth in low emissions investment in coming decades, even in the absence of new policy drivers.

The reorientation of global investment has begun. The private sector is beginning to limit financing for fossil fuel projects—particularly thermal coal—and sustainable finance is growing, although the shift remains in the early stages. Over 100 major institutional investors and banks have placed restrictions on lending to new coal mining and generation projects, and insurers have started withdrawing coverage. In contrast, sustainable finance markets have grown by a factor of eleven since 2014, with sustainable debt issuances reaching US\$730 billion in 2020.

The global financial system is being regeared to manage climate risk, drive low emissions investment and promote decarbonisation. Building on the work of markets and regulators, major economies are moving to require investors and businesses to disclose their exposure to climate-related financial risks, and to develop classification systems (so-called ‘taxonomies’) that identify what constitutes a sustainable investment.

The emergence of international cooperation on sustainable finance could have implications for global capital flows. Economies representing over half of global GDP have signed up to the International Platform on Sustainable Finance, which is coordinating approaches to sustainable finance.

New investment rules could have significant implications for Australia. Australia will increasingly need to show that investment opportunities align with a Paris-aligned decarbonisation trajectory to attract global capital. This represents both a risk and opportunity for Australian industry.

Governments are deploying a range of fiscal policies and financial incentives to boost public and private investment in low emissions sectors. Many economic stimulus packages deployed in response to the COVID-19 pandemic are accelerating emissions reduction and leveraging low emissions investment funds.

Global progress towards net zero emissions will see a significant shift in global investment from high to low emitting activities. Financial regulation and investment policy have emerged as key drivers of low carbon investment. Governments of major economies—including many of the largest foreign investors in Australia (Table 1.1)—have established sustainable finance frameworks, and some are using COVID-19 recovery packages to lay the foundation for private investment in low emitting sectors. Central banks and regulators are taking action to fortify the global financial system against climate-related risk, while investors are moving to manage the risks that climate change poses to their returns and portfolios. The International Energy Agency’s (IEA) recent *Net-Zero by 2050* report has highlighted the risks investors face in financing fossil fuel projects, especially coal-fired generation and coal, oil and gas extraction projects (IEA 2021c).

¹ Low carbon investment includes investment in energy efficiency, electric vehicle charging infrastructure and incremental spending on electric vehicles, CCUS in industry, renewable generation, renewable end uses, nuclear, battery storage, biofuels, and fossil fuels with CCUS. Investment in electricity networks is excluded.

Part 1 of this report provides an overview of trends in low carbon investment and finance, analyses the key drivers of these trends, and outlines the likely future trajectory of capital flows in a global low emissions economy. It focuses on low carbon energy investment (Box 1.1), where comprehensive and comparable global data are readily available. The data are disaggregated to three sectors: fuel supply, power generation and end use, which collectively account for around 72 per cent of global emissions (C2ES n.d.).

While the report notes the observable low carbon investment trends in sectors that produce emissions from some non-energy related sources—for example agriculture and land use, and industrial processes—it does not provide a comprehensive analysis of the investment trends for these sectors, due to the lack of comparable, robust global data and projections.

Table 1.1: Australia's major foreign investment partners and net zero targets, 2020

	Mid-century net zero target	Investment into Australia, A\$ billion	Share of total investment, %
 1) United States	2050	929	23
 2) European Union	2050	779	20
 3) United Kingdom	2050	738	18
 4) Japan	2050	265	7
 5) Hong Kong	2050	142	4
 6) Singapore	-	117	3
 7) China	2060	79	2
 8) New Zealand	2050	66	2
 9) Canada	2050	65	2
 10) Switzerland	2050	57	1
 Net zero major partners	-	3120	78
 Non net zero major partners	-	117	3
 Other partners	-	755	19
Total	-	3991	100

Source: ABS 2021a; Energy & Climate Intelligence Unit 2020; ClimateWatch 2021.

Notes: Singapore is aiming to achieve net zero emissions “as soon as viable in the second half of the century”. Several countries outside Australia's top 10 investment partners have net zero mid-century targets. Figures may not sum due to rounding.

1.1 Low carbon investment trends

Current state of energy investment

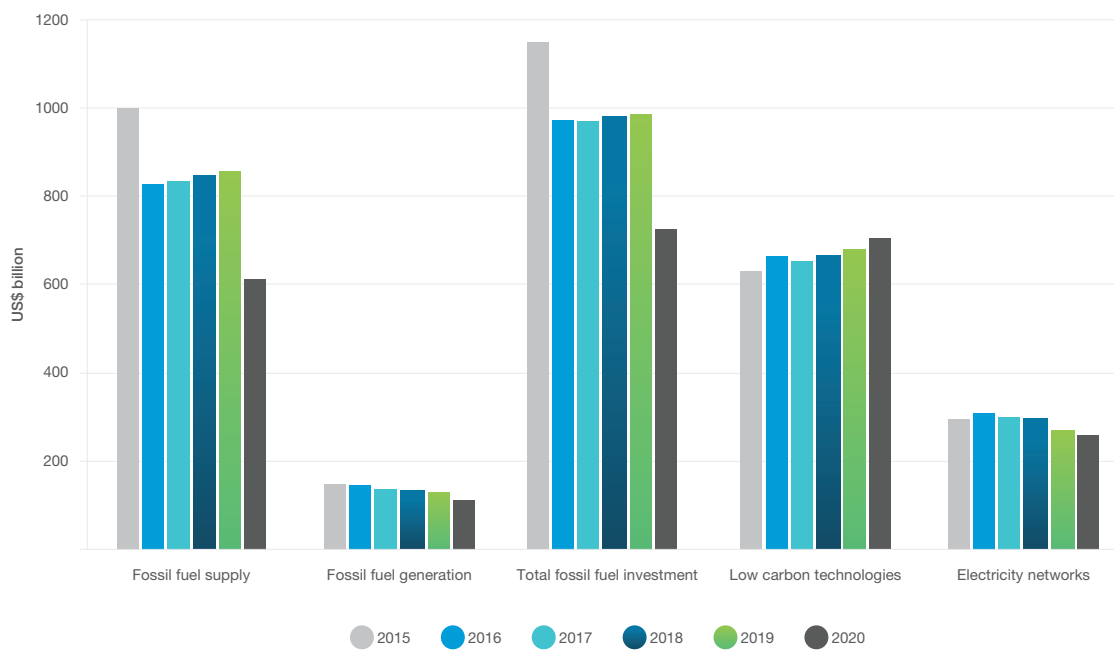
Fossil fuels—coal, oil and natural gas—dominate the world energy system, accounting for around 80 per cent of the global energy mix. Historically, this has been reflected in the composition of global energy investment (Box 1.1), with fossil fuel investment easily outweighing other types of energy investment until as recently as 2019 (IEA 2020a; IEA 2021d). In 2019, fossil fuels accounted for over half of global energy investment and low carbon technologies around a third, with the remainder in electricity networks.

Box 1.1: What is energy investment?

Energy investment refers to all capital spending on energy supply and energy efficiency (IEA 2020a). The data are divided into three sectors:

- **fuel supply**, which covers investments in the production of oil, coal, gas and low carbon fuel (e.g. biofuels)
- **the power sector**, which covers investment in generation technologies, storage and grid networks
- **the end use sector**, which covers investment in energy efficiency improvements in buildings, the transport sector, industry, including manufacturing, and investment in heat generated from renewable sources.

In 2020, the gap between fossil fuel investment and low carbon investment narrowed substantially (Figure 1.1). Low carbon investment remained resilient to the impacts of COVID-19 and continued to increase, reaching around US\$700 billion (Figure 1.1). In contrast, fossil fuel investment fell sharply, from close to US\$1 trillion to around US\$730 billion. The contraction in energy demand in 2020 as a result of the COVID-19 pandemic led to declines in coal, oil and gas prices (DISER 2021a), causing developers of fossil projects to cut back heavily on capital expenditure plans (IEA 2021c).

Figure 1.1: Global energy investment

Source: IEA 2021d.

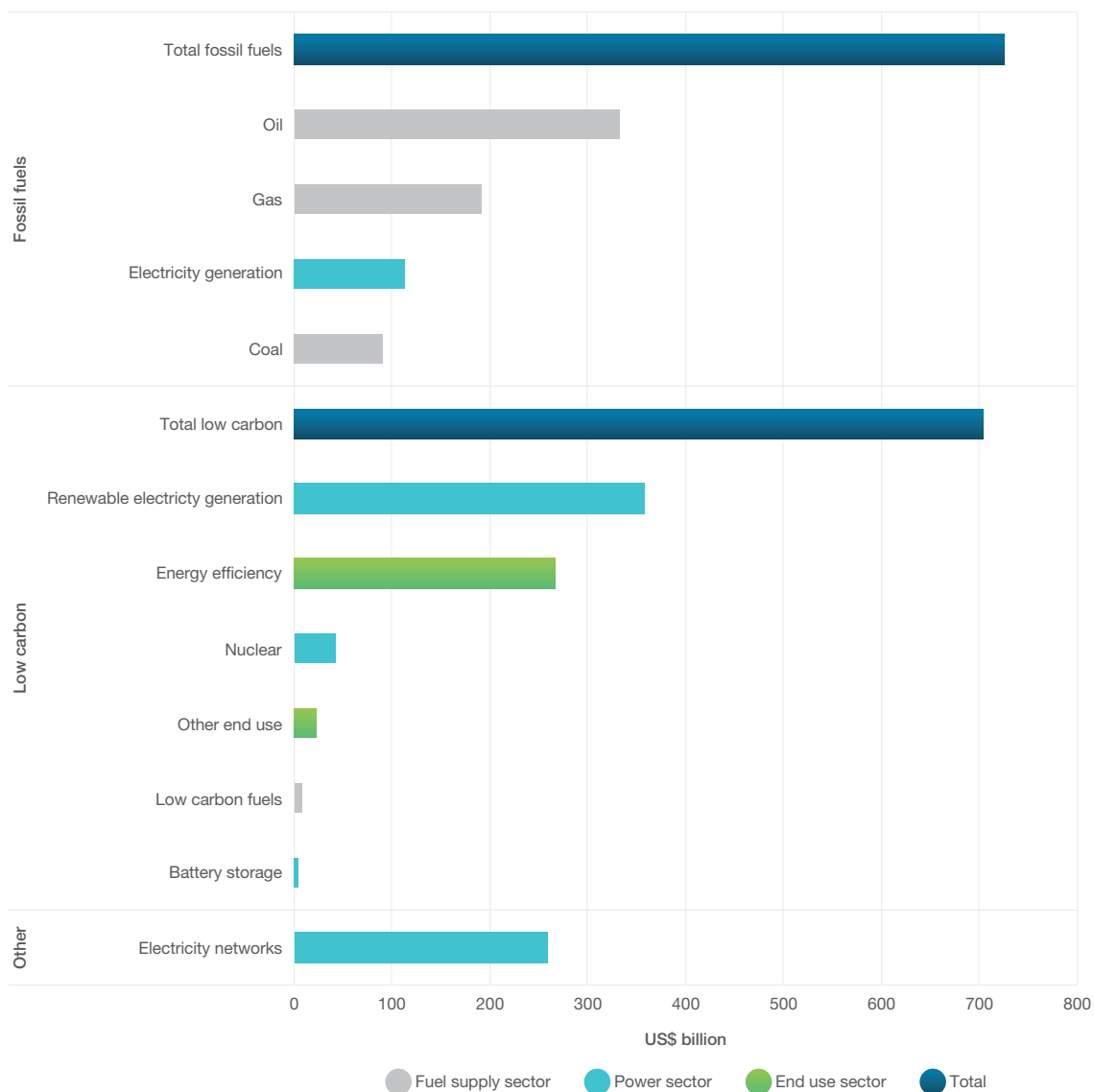
In 2020, the bulk of investment in fossil fuels was directed towards the development of new oil, gas and coal supplies, with fossil fuel investment in the power sector more limited (Figure 1.1) (Box 1.1). In contrast, low carbon investment was concentrated in the power and end use sectors. In the power sector, investment in renewable generation stood at US\$360 billion and investment in nuclear generation was around US\$40 billion (Figure 1.2). Low carbon investment in the end use sector was US\$290 billion, the vast majority of which was in energy efficiency (Figure 1.2).

Investment in high-profile frontier technologies is growing but remains small. In 2020, investment in battery storage technologies was US\$6 billion (Figure 1.2). Investment in low carbon fuels—biofuels, biogases and hydrogen—totalled just US\$8 billion (Figure 1.2). Hydrogen investment—commercial fuel cell vehicles, electrolysis, refuelling stations, fuel cell buses and passenger vehicles—was around US\$1.5 billion (BloombergNEF 2021a). Investment in carbon capture and storage (CCS) technology stood at around US\$3 billion (BloombergNEF 2021a). On a Paris-aligned decarbonisation trajectory, investment in these frontier technologies would increase substantially, presenting opportunities for Australia.

The long-term prospects for fossil fuel and low carbon investment on a Paris-aligned decarbonisation trajectory is discussed in Part 1, Section 1.3 of this report. If global decarbonisation objectives are met, unabated fossil fuel investment will average less than US\$600 billion per annum over the next 30 years, while low carbon investment would triple to average US\$2.4 trillion per annum over the same time period (IEA 2019a).

Part 1: Investment and finance

Figure 1.2: Global energy investment in fossil fuels and low carbon technologies, 2020



Source: IEA 2021d.

Notes: 'Other end use' includes renewables for end uses (e.g. solar thermal applications for water heating), incremental spending on electric vehicles (EV) (i.e. the additional cost of an EV relative to an internal combustion engine vehicle of the same class), EV charging infrastructure and carbon capture usage and storage in industry.

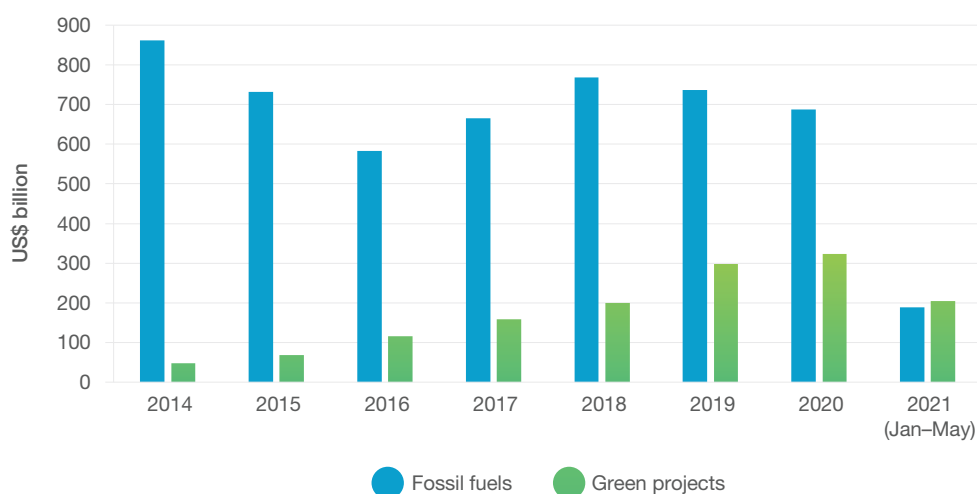
Shifts in financing and investment

Fossil fuel project developers—especially developers of thermal coal projects—are beginning to face tighter financing conditions, which should raise the cost of capital for new fossil fuel projects, while insurers are also starting to withdraw coverage. Lower emissions energy projects are not facing the same pressures.

However, the shift away from fossil fuel financing is just beginning. The world's 60 largest commercial and investment banks collectively reduced their financing of fossil fuel projects for the first time in 2020, and yet fossil fuel financing remained well above 2016 levels—the year after the Paris Agreement was signed (Rainforest Action Network et al. 2021). It will take some time for institutions to implement recent financing commitments, and timeframes for stated goals are often decades into the future. There also remain legacy projects in the pipeline for which financing was approved many years ago.

Nevertheless, in 2021, financing constraints on fossil fuel projects appear to have tightened. Data from BloombergGreen, which covers almost 140 financial service institutions worldwide, suggest that financing (bonds and loans) for fossil fuel projects recorded a steep decline over the first five months of 2021 (Figure 1.3). On an annualised basis, fossil fuel financing fell to US\$450 billion over the first five months of 2021, compared to US\$690 billion in 2020 (Quinson & Benhamou 2021a). In contrast, financing for green projects continued to increase and overtook fossil fuel financing, reaching an annualised US\$490 billion. Lending to coal companies was around an annualised US\$16 billion over the first five months of 2021, compared to an annualised US\$46 billion for the same period in 2020 (Quinson & Benhamou 2021b).

Figure 1.3: Fossil fuel and green financing



Source: Quinson & Benhamou 2021b.

Over 1,300 institutions with more than US\$14 trillion in assets under management have committed to divesting from fossil fuels (Go Fossil Free 2020), compared with divestment commitments of US\$52 billion in 2014 (Go Fossil Free 2018).

Coal

Private sector financing for coal projects, and in particular coal-fired generation and thermal coal mining projects, has become more difficult to obtain. A growing number of banks and asset managers around the world, including in Australia (Table 1.2), are placing restrictions on their lending and investment activities for coal projects. In 2020, United States investment company Blackrock—the world's largest asset manager with almost US\$9 trillion of assets under management—announced that it would exclude from its discretionary actively-managed portfolio companies that generate more than 25 per cent of their revenues from thermal coal production (Blackrock 2020; Blackrock 2021a).

Many investors are joining corporate initiatives to coordinate divestment activity and maximise influence and impact. For example, the Net-Zero Asset Owner Alliance—convened by the United Nations (UN)—has called for the cancellation of all thermal coal mines, coal-fired power stations and related infrastructure that are pre-construction, and the phasing out of coal-fired electricity generation globally by 2040 (Net-Zero Asset Owner Alliance 2020).²

Insurers—the world's second largest group of institutional investors after pension funds (Insure Our Future n.d.)—are following similar trends. At least 65 insurers with combined investments worth US\$12 trillion—around 40 per cent of the industry's total assets—have adopted a divestment policy or committed to making no new investments in coal (Insure Our Future 2020), including a number of Australian insurers (Table 1.2).

Insurers are also placing restrictions on the cover they offer for coal projects. At least 23 insurers and reinsurers—accounting for approximately 13 per cent and 48 per cent of these markets respectively—have ended or limited insurance cover for coal projects (Insure Our Future 2020).

Table 1.2: Restrictions on fossil fuel financing by major Australian financial institutions

Institution	Type	Assets/ market cap	Fossil fuel	Restrictions
Aware Super	Asset Manager	A\$125 billion (assets)	Coal	Divesting from companies that derive more than 10 per cent of their revenue from thermal coal by October 2020.
Macquarie Group	Asset Manager/Bank	A\$64 billion (market cap)	Coal	Will fully divest from the coal sector by 2024.
HESTA	Asset Manager	A\$52 billion (assets)	Coal	Will fully divest from companies deriving more than 15 per cent of revenue from thermal coal.
ANZ	Bank	A\$80 billion (market cap)	Coal	Will not finance new builds of conventional coal-fired power plants.
Commonwealth Bank of Australia	Bank	A\$152 billion (market cap)	Coal	Zero thermal coal exposure by 2030.

² Net-Zero Asset Owner Alliance members manage over US\$7 trillion in assets and have committed to transitioning investment portfolios to carbon neutrality by 2050.

Institution	Type	Assets/ market cap	Fossil fuel	Restrictions
National Australia Bank (NAB)	Bank	A\$86 billion (market cap)	Coal	Cap thermal coal mining exposures at 2019 levels, reducing by 50 per cent by 2028 and effectively zero by 2035.
NAB	Bank	-	Oil / gas	Will not finance oil/tar sands extraction projects or oil and gas projects in the Arctic or Antarctic.
Westpac	Bank	A\$90 billion (market cap)	Coal	No new financing for thermal coal mining and coal-fired power generation and reduce exposure to existing thermal coal to zero by 2030.
Export Finance and Insurance Corporation	Export Credit Agency	-	Coal	Excludes coal power unless Ultra Super Critical with emissions <750g CO ₂ /kWh.
IAG	Insurer/ Reinsurer	A\$12 billion (market cap)	Coal	Ceasing underwriting entities predominately in the business of extracting fossil fuels and power generation using fossil fuels by 2023.
QBE of Australia	Insurer/ Reinsurer	A\$14 billion (market cap)	Coal	Zero thermal coal exposure by 2030.
Suncorp	Insurer/ Reinsurer	A\$13 billion (market cap)	Coal	Zero thermal coal exposure by 2025.
Suncorp	Insurer/ Reinsurer	-	Oil / gas	Phase out direct investment in oil and gas exploration and production by 2040 with interim targets for 2025 and 2030.

Source: IEEFA 2021b; Suncorp 2020; Aware Super 2020; Aware Super n.d.; ASX 2021; Market Index 2021; NAB 2021; HESTA 2020.

Notes: Market cap data retrieved in March and September 2021.

Governments and state-backed financial institutions are also increasingly reviewing the financing of coal projects. South Korea and Japan have historically been major financiers of coal-fired power plants (Global Energy Monitor 2020). At the April 2021 Leaders' Summit on Climate led by the United States, South Korea announced that it would terminate public overseas coal financing (U.S. Department of State 2021). In June 2021, Europe and the G7 countries—which includes Japan and other major economies—committed to “an end to new direct government support for unabated international thermal coal power generation by the end of 2021, including through Official Development Assistance, export finance, investment, and financial and trade promotion support” (G7 leaders 2021).

China until recently was the lender of last resort for new coal financing, but at the UN General Assembly in September 2021 announced it would cease funding for overseas coal projects (United Nations 2021). According to the International Institute for Green Finance's Green Belt and Road Initiative Center, China did not announce any new funding for overseas coal-fired power plant projects in 2020: the first time this has occurred since the Chinese Government adopted the Belt and Road Initiative in 2013 (Wang 2021).

International institutions are also looking to restrict coal financing. Under its draft May 2021 energy policy, the Asian Development Bank (ADB) will end financing for coal mining and coal-fired power (ADB 2021). Moreover, the ADB is reportedly leading a plan—in partnership with some of the world's largest financial firms, including Blackrock, HSBC and Citi—to accelerate the early closure of coal-fired power plants across Asia (Denina & Burton 2021).

In total, over 160 major banks, export credit agencies, insurers and asset managers have announced restrictions on coal financing (IEEFA 2021a; IEEFA 2021b). As a result, the pool of capital for new coal-fired power generation and coal mining projects is shrinking and financing terms are becoming more restrictive (IEA 2020a). A trend decline in investment in new coal projects is emerging, particularly for new power generation projects (Box 1.2). The future of Australia's coal exports under a Paris-aligned decarbonisation trajectory is discussed in Part 3.

Box 1.2. Financing new coal-fired power generation in Southeast Asia and India

Southeast Asia and India have long been seen as the last bastion of thermal coal demand, with demand soon expected to peak in China and consumption already falling across Europe, North America and other parts of Asia (DISER 2019a; DISER 2020a). While consumption of thermal coal is likely to increase in both Southeast Asia and India in the short term (DISER 2020a), the long term prospects for demand are highly uncertain.

Over the past few years, cancellations of coal-fired power projects have been growing. India's pipeline of projects shrunk from 238 gigawatts in 2015 to 30 gigawatts in 2020, while Southeast Asia's declined from 126 gigawatts to 70 gigawatts over the same period (Global Energy Monitor 2020).

A raft of recent announcements could further threaten future investment in coal-fired power generation and see the overall pipeline of coal-fired projects in Southeast Asia continue to shrink (United Nations 2021; Global Energy Monitor 2020; Burke & Nguyen 2021; Hamdi & Adhiguna 2021; Government of Indonesia 2021):

- China, the world's largest public financier of overseas coal, has announced that it will cease funding for new coal-fired power plants abroad
- Bangladesh has finalised plans to cancel all coal plants not currently under construction
- the Philippines has declared a moratorium on new coal plants
- Vietnam has released a draft of its Power Development Plan VIII for the period to 2030, under which there would be no additional development of new coal-fired thermal power other than coal-fired power plants already under construction or investment and promoted for operation between 2021 and 2025
- Indonesia has indicated it will not permit any new coal-fired power, except for those projects that are already under construction or have reached financial close. In its Long-Term Strategy for Low Carbon and Emissions Resilience, the Indonesian Government states that coal-fired power will continue to make up 38 per cent of the country's power mix in 2050, with around 76 per cent of coal power plants expected to be equipped with CCS technologies.

Oil and gas

Constraints on financing for oil and gas projects are also emerging. Over 70 banks, asset managers and insurers have announced restrictions on their activities in the oil and gas sector, mainly on oil tar sands and Arctic drilling (IEEFA 2021c). Norway's sovereign wealth fund—the largest in the world with over US\$1 trillion in assets—has reportedly completed the sale of its entire portfolio of companies that solely focus on oil exploration and production (Taraldsen 2020).

The European Investment Bank has committed to phase out the financing of unabated fossil fuel projects, including natural gas, by the end of 2021 (EIB n.d.). The United Kingdom has also announced that it will end direct government support for overseas fossil fuel projects, including oil and gas, with very limited exceptions (UK Government 2020a).

Under its draft energy policy, the ADB will not finance oil and natural gas field development, and will only finance downstream natural gas projects if they align with targets to achieve carbon neutrality by mid-century (ADB 2021). The World Bank Group (WBG), which has not financed a new coal-fired power plant since 2010 (The World Bank 2020), released its *Climate Change Action Plan 2021–2025* in June 2021. Under the plan, the WBG has committed to align its financing flows with the objectives of the Paris Agreement to further “mainstream” climate into its development activities and maximise the impact of climate finance (WBG 2021). The WBG's sister organisation, the International Finance Corporation and Multilateral Investment Guarantee Agency, is reportedly seeking to take similar steps (Volcovici, Shalal & Abnett, 2021).

Growth in sustainable finance and investment

In contrast to the shrinking availability of finance for high emitting energy sources, sustainable finance and investment has grown rapidly since its inception more than a decade ago. The issuance of sustainable debt—borrowing activity via bonds and loans—continued to increase in 2020, reaching over US\$700 billion, despite the economic impacts of COVID-19 (BloombergNEF 2021b).

While sustainable debt has grown rapidly, it remains small in the context of overall global debt. In 2020, the size of the global bond market alone was around US\$130 trillion (ICMA 2020). However, not all low emissions investments are financed through sustainable finance bonds and loans. As such, growth in sustainable finance should be considered an indication of a broader trends within the financial sector (see Section 1.3), rather than a precise measurement.

Green bonds—bonds where the proceeds are earmarked for projects with environmental or climate benefits (Figure 1.4)—are the largest and most established type of sustainable debt. For an issuer, green bonds are an opportunity to highlight green investments and diversify the investor base by attracting investors interested in environmental, social and corporate governance (ESG) issues (CBI 2021). Likewise, investors see green bonds as a way of promoting their own environmental credentials and ensuring investments achieve particular goals.

Figure 1.4: Types of sustainable debt

Bonds

Green bond

100% of proceeds used for eligible environmental activities

Sustainability bond

100% of proceeds used for activities with environmental and social co-benefits

Sustainability-linked bond

General purpose debt, issuer commits to green and/or social target

Social bond

100% of proceeds used for eligible social activities



Loans

Green loan

100% of proceeds used for eligible environmental activities

Sustainability-linked loan

General purpose debt, issuer commits to green and/or social target

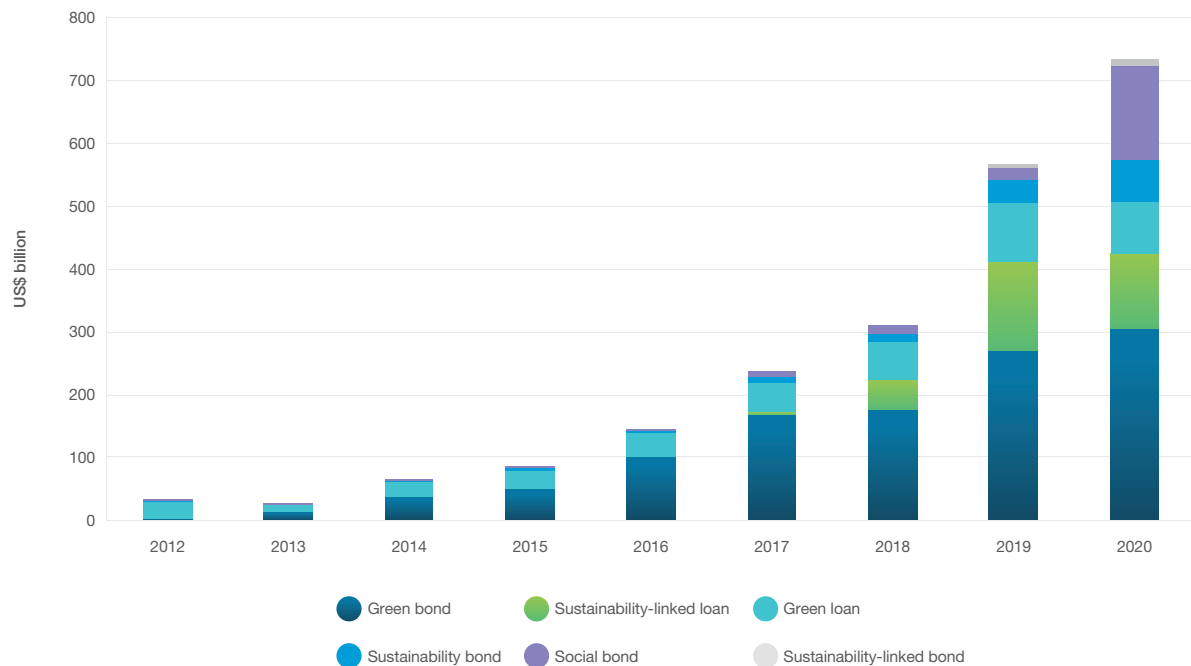
Source: BloombergNEF 2021b.

Since the European Investment Bank issued the first green bond in 2007 (EIB 2017), an increasing number of governments (both national and local), government-backed agencies, financial institutions, corporations and international institutions have used green bonds to raise capital. In September 2020, governments in 16 countries had issued sovereign green bonds, including Germany, France, Belgium, the Netherlands, South Korea, Hong Kong and Indonesia (OECD 2020). Major companies and lenders that have issued green bonds include Apple, Unilever, Engie and, Credit Agricole and Bank of America (CBI 2021).

In Australia, green bond issuers include corporations (Woolworths, Brookfield Properties), banks (NAB, ANZ, Commonwealth Bank, Westpac) and sub-national institutions (Queensland Treasury Corporation, New South Wales T-Corp, the Treasury Corp of Victoria) (Climate Bonds Initiative 2019b). The Australian Government-funded Clean Energy Finance Corporation (CEFC) has been an anchor investor in many of these bonds (Lovell 2019).

Figure 1.5 shows the rapid growth in sustainable debt issuances globally. Sustainable debt issuances have increased from around US\$30 billion in 2012 to around US\$730 billion in 2020 (BloombergNEF 2021c). Venture capital investment into technologies aimed at combatting climate change (not included in this data) reportedly reached a record high of US\$16.4 billion in 2020 (Harder 2021).

Figure 1.5: Sustainable debt issued globally by instrument type, 2012–2020



Source: BloombergNEF 2021b.

As sustainable finance markets continue to grow, governance arrangements are emerging in the form of regulations, guidelines and frameworks. For example:

- the International Capital Markets Association's Green Bond Principles provide guidance on the process for the issuance of green bonds, which allows investors, banks, underwriters and other stakeholders to understand the characteristics of a given green bond (ICMA 2018)
- the Climate Bonds Initiative has established a certification scheme for bonds and loans that helps bond issuers, governments and investors and financial markets understand which investments are consistent with the 2°C goal of the Paris Agreement (Climate Bonds Initiative 2021a)
- the Loan Market Association, Asia-Pacific Loan Market Association and Loan Syndications and Trading Association have developed a similar set of voluntary international guidelines for the green loan market (LMA, APLMA & LSTA 2018).

Countries are also seeking to standardise sustainable finance products. The People's Bank of China has developed Financial Bond Guidelines for green bonds issued by financial institutions, and the European Union has established a Green Bond Standard aimed at standardising green securities (Godemer 2021).

Driven by large institutional investors, sustainable finance is predicted to scale up rapidly over coming decades. The world's largest asset manager, Blackrock, has recently placed sustainability at the centre of its investment strategy, noting that "climate risk is investment risk" and that "the climate transition presents a historic investment opportunity" (Blackrock 2020b). In early 2020, Blackrock launched a sweeping series of initiatives that: 1) further incorporated sustainability into the way Blackrock manages risks, constructs portfolios and designs products; 2) increased access to sustainable investing; and 3) increased Blackrock's engagement with the companies it invests in on sustainability issues (Blackrock 2020b).

Part 1: Investment and finance

Other large institutional investors have announced net zero targets. Macquarie Asset Management—a top 50 global asset manager (Macquarie 2020a)—has announced it will manage its portfolio in line with a net zero by 2040 commitment (Macquarie 2020b). Major international banks are also ratcheting up sustainable financing. For example, global bank HSBC, has committed to providing US\$100 billion in sustainable investment and financing by 2025 (HSBC 2017).

The Investor Group on Climate Change's June 2021 survey of Australian and New Zealand institutional investors—which represent over A\$3.1 trillion in collective assets under management globally—found that over 40 per cent of respondents have made a portfolio wide commitment to net zero emissions by 2050, up from 27 per cent in 2020 (IGCC 2021).

In Australia, several superannuation funds have committed to net zero targets for their portfolios (Table 1.3), although they remain in the minority (ClimateWorks 2020a). The Australian Council of Superannuation Investors—a peak body representing around 37 of Australia's superannuation and institutional investors—is engaging with companies on behalf of its member superannuation funds to encourage companies to report and manage climate risk (ClimateWorks 2020a).

Major Australian banks are also taking action to reduce portfolio emissions by committing to the Science Based Targets initiative (SBTi), working with the Australian Prudential Regulatory Authority (APRA) on the development of a standardised Climate Vulnerability Assessment (APRA 2021a) and setting net zero targets for some (but not all) lending activities, although initiatives are still not yet aligned with achieving net zero emissions by 2050 (ClimateWorks 2019).

Table 1.3: Net zero targets of selected Australian superannuation funds

Institution	Total assets, A\$ billion	Target
UniSuper	83	Net zero by 2050 portfolio target supported by interim goals and strategies
HESTA	54	Net zero by 2050 portfolio target and a reduction of one-third by 2030
Cbus	53	Net zero by 2050 portfolio target and a 45 per cent reduction by 2030
Aware Super	103	Aspirational net zero by 2050 target and reduction in emissions in its listed equities portfolio by at least 30 per cent by 2023
AMP	73	Net zero target by 2030 for its property portfolio

Source: ClimateWorks 2020a.

1.2 The drivers of low carbon investment

As a nation reliant on export markets and foreign investment, the future of low carbon investment, sustainable finance, and climate risk reporting matter for Australia. The acceleration in low carbon investment is being driven by the recent ratcheting up of climate ambition by the governments of some of the world's largest and biggest emitting economies, coupled with rapid reductions in the cost of low emissions technologies. For example, over the past 10 years, solar photovoltaic (PV) costs have fallen by around 85 per cent, while the cost of onshore and offshore wind has fallen by around 55 per cent (Henze 2020). This has created a marked shift in the underlying economics in energy markets. Three additional drivers are facilitating and supporting this momentum:

- the recognition, reporting and regulation of climate-related risk
- the development and implementation of sustainable finance plans of major economies
- direct government investment in the low emissions economy designed to stimulate further private investment.

The recognition and reporting of climate-related risk

Information on climate-related risk has garnered increasing public attention year-on-year, especially since 2015, following two key events. The first was a landmark speech by then Bank of England Governor and Chair Mark Carney, in which he identified climate change as a key risk to the stability of the financial system (Carney 2015). The second was the signing of the Paris Agreement, which signalled the intent of countries to rapidly reduce emissions at a pace that could potentially lead to the devaluation of assets worth trillions of dollars (Barrett & Skarbek 2019).

The subsequent shift in public perception and understanding of climate-related risks has led to growing recognition, especially within the private sector, that these risks need to be reported on and managed effectively. Climate-related risk disclosure has become an increasingly common, though not yet mainstream, feature of corporate sustainability reporting since 2015. The Taskforce on Climate-related Financial Disclosure (TCFD) has played a crucial role in catalysing this shift.

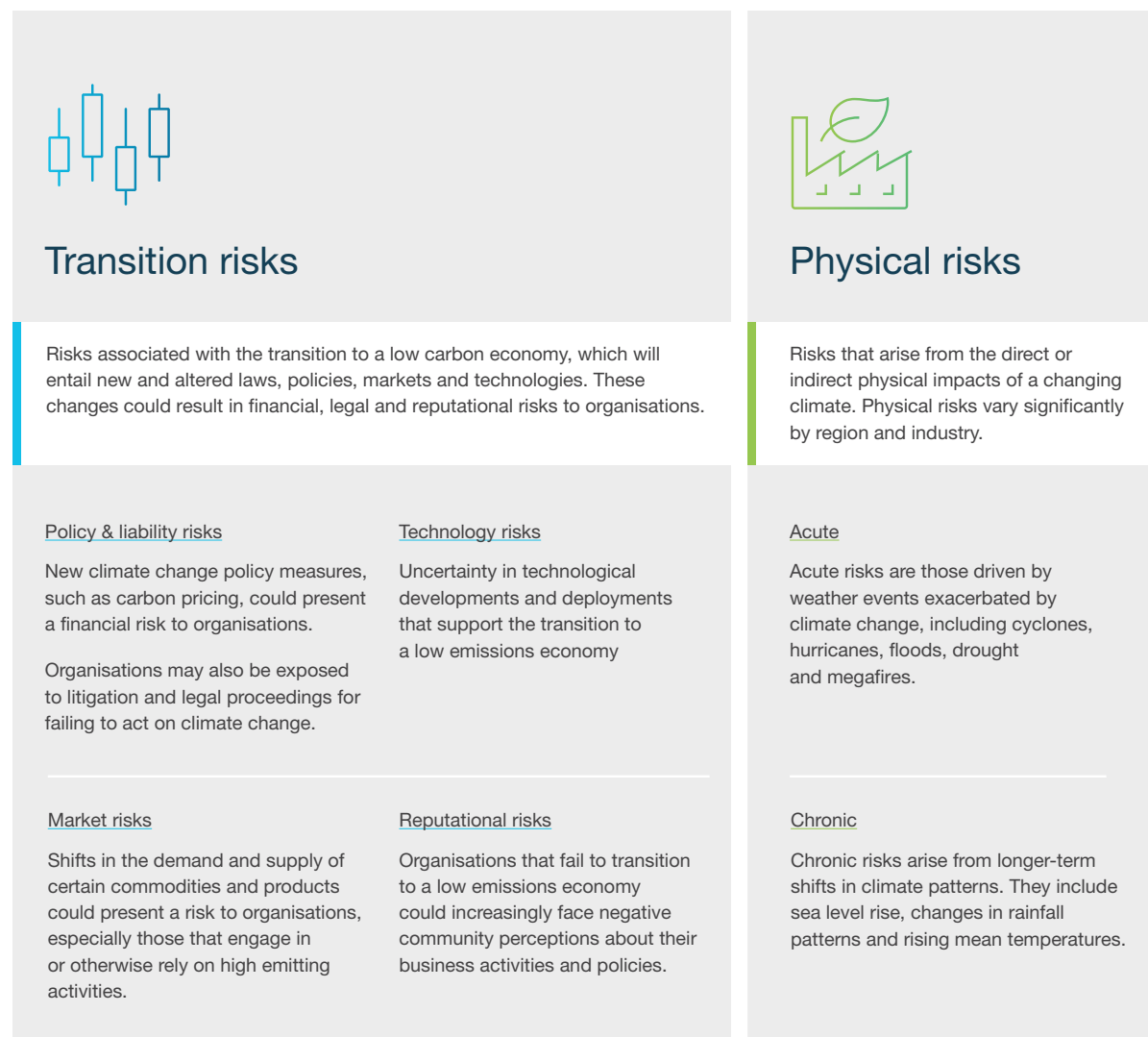
Taskforce on Climate-related Financial Disclosures

The TCFD was created to help companies account for climate change in assessing risks, allocating capital and undertaking strategic planning. It was established by the Financial Stability Board (FSB)—an international body that monitors and makes recommendations relating to the global financial system—and announced by its Chair at the time, Mark Carney, at the COP21³ Paris climate change conference in 2015.

The impetus for the TCFD was a growing recognition by the international finance community that financial markets lacked sufficient information to accurately price climate-related risks and correctly value climate risk exposed assets, resulting in an inefficient allocation of capital. Access to high quality financial information underlies markets' ability to price climate-related risk in order to prevent sharp corrections in the future which, in a worst case scenario, could threaten the stability of the global financial system (TCFD n.d.a; FSB 2020a).

The TCFD delivered its final recommendations in June 2017. The report outlined a comprehensive framework for voluntary disclosure by companies of climate-related financial risks to help inform lenders, investors, insurers and other stakeholders of the material risks arising from climate change. The TCFD recommends that climate-related disclosure be focused on four core areas: governance, strategy, risk management and metrics and targets. It also recommends that companies include climate risk disclosures in their annual financial filings, and identifies two major categories of risk that climate change poses to the finance sector and economies more broadly: risks related to the physical impacts of climate change, and risks related to the transition to a low emissions economy (Figure 1.6) (TCFD 2017).

³ COP21: The 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

Figure 1.6: Transition and physical climate risks

Source: TCFD 2017.

Physical risks

Physical climate-related risks are already affecting the ability of the insurance sector to underwrite economic activity. This is due to the increasing size and frequency of insured losses for climate-related natural disasters (Reserve Bank of Australia 2019). Many households and businesses are already seeing, and will continue to see, rising insurance premiums, as well as a growing number of coinsurance arrangements and uninsurable risks. As such, the insurance and reinsurance sectors will affect societal change in relation to the physical risks of climate change; indirectly regulating how and where people reside and invest, among other things.

During the past decade, inflation adjusted insurance claims for natural disasters in Australia were more than double those in the decade prior (RBA 2019). The Reserve Bank of Australia (RBA) has warned that while insurers can increase premiums to reflect growing risks associated with a changing climate, the possibility of under-pricing is high and the implications are potentially detrimental (RBA 2019). So too, overpricing could undermine the risk pooling system that underlies the insurance sector's business model.

Insurers have expressed concerns over whether, increased premiums aside, the reinsurance market will continue to underwrite certain risks. Where the probability of a risk occurring is high, and the severity of loss or damage associated with that risk is also high, the risk may become uninsurable. Uninsurable risks are ultimately borne by households, businesses and governments (RBA 2019). Small-to-medium sized enterprises (SMEs) in rural and regional Australia are already facing difficulties obtaining insurance coverage against fires and floods, leaving them highly exposed to financial risk or unable to continue operating (ASBFEO 2020).

Very high risks and losses have already been observed in northern Australia (ACCC 2020). The Australian Competition and Consumer Commission (ACCC) recently finalised its inquiry into the availability and affordability of insurance in northern Australia. The final report confirms that strata, home and contents insurance premiums in northern Australia are considerably higher and have risen faster than for the rest of Australia, with the “main driver of higher premiums in northern Australia [being] the higher natural peril risk” due to the prevalence of cyclones and, in some places, flooding (ACCC 2020).

In its submission to the inquiry, major Australian insurer Suncorp states that insurers must factor the risk of future catastrophes into northern Australian premiums, that a lack of disaster mitigation and planning has impacted Northern Australian policy holders to date, and that mitigation and climate adaptation must dominate future policy responses (Suncorp 2020). The ACCC notes in its findings that while insurers consider climate change to be “a risk to their business” because it is likely to “affect the frequency and intensity of natural peril risks”, the industry currently lacks the capability to accurately incorporate climate risk into insurance premiums, as modelling is based on historical weather and climate data (ACCC 2020).

Among other tools for assessing risk and probability, climate change attribution science may play a role in addressing this knowledge gap in coming decades, if its accuracy can be assured. Major advancements are underway in the field, which seeks to determine the causal link between climate change and the likelihood and severity of extreme weather events. In 2020, the Massachusetts Institute of Technology listed climate change attribution science as one of the year's top 10 technological breakthroughs, pointing to rapid improvements in climate simulation tools and techniques made possible by advancements in satellite data and computing power (Temple 2020).

Transition risks

Transition risks associated with climate change include the potential for stranded assets: those that have their expected economic life curtailed as a result of the shift towards net zero emissions. The energy transition alone may give rise to billions of dollars in stranded fossil fuel assets if it is not carefully managed.

Global Energy Monitor—a non-governmental organisation that catalogues fossil fuel projects worldwide—estimates that up to US\$91 billion in proposed coal mine development and expansion projects risks becoming stranded in the global energy transition (Tate, Shearer & Matikinca 2021). Energy transition risks can also affect companies' credit ratings. In early 2021, S&P Global lowered the credit ratings of United States oil majors ExxonMobil, Chevron and ConocoPhillips to reflect growing risk from the energy transition due to climate change (Crowley 2021).

In Australia, leading electricity generator AGL Energy announced almost A\$2.7 billion in write-downs in early 2021 due to the drop in wholesale electricity prices brought about by the penetration of renewables into the grid (AGL 2021). These write-downs were not only driven by impairments to AGL's fossil fuel generation and natural gas assets, but also reflected that wholesale prices were lower than prices in AGL's offtake agreements with some wind farms. The write-downs illustrate the potentially complex impacts of transition risks.

Transition risks are especially likely to arise under a disorderly transition scenario, which by definition entails sudden, unanticipated and disruptive responses to the physical risks arising from climate change (NGFS 2020a). A disorderly transition can reasonably be expected to cause abrupt changes to the value and risk premium of assets across a variety of classes, causing the availability of credit for these assets to dry up, which would lead to liquidity problems and a sudden and potentially destabilising spike (CCA 2020; FSB 2020a).

Corporate liability risks—another type of transition risk—are already materialising in a number of countries around the world, including Australia. Australia has the second highest volume of climate-related litigation of any country in the world, with over 200 total cases filed to date (Setzer & Byrnes 2020). Legal action is increasingly being taken against companies for their causal contributions to climate change; against fund managers and fiduciaries for not properly considering and managing climate-related risk; against company directors for misleading and deceptive conduct on climate-related risks; and against governments and public bodies for their failure to respond to these risks (Setzer & Byrnes 2019) (Box 1.3).

In May 2021, a Dutch district court ruled that Royal Dutch Shell is obligated to reduce its emissions by 45 per cent by 2030 from 2019 levels, in line with the Paris Agreement's objectives. The ruling—the first in history to compel a private company to reduce its emissions in accordance with global climate goals—applies not only the company's scope 1 and 2 and but also scope 3 emissions⁴, and covers the company's global operations (*Milieudefensie et al. v Royal Dutch Shell PLC* 2021).

Growth in TCFD-aligned reporting

TCFD-aligned reporting is gaining rapid momentum, and institutional investors have influenced this trend. Growing awareness of and concerns over climate-related risks have resulted in an increase in the uptake of TCFD-aligned reporting (FSB 2020b). Investors in particular are starting to demand more comparable information from companies in relation to their climate risk profile, and are putting pressure on companies to manage climate risk by adopting long term business strategies that take into account the need to decarbonise by mid-century (IEA 2019a). As of October 2020, more than 1,300 investors and companies—with a market capitalisation of over US\$12.6 trillion—had announced their official support for the recommendations of the TCFD (TCFD 2020). According to an Australian Council of Superannuation Investors report, informed by public reporting of ASX200 companies up to March 2021, disclosure against the TCFD is rapidly accelerating, with 80 of the 200 companies having adopted the framework by 2020 (up from 11 in Financial Year 2017) (ACSI 2021).

A major initiative working to improve TCFD-aligned reporting standards and tools is Climate Action 100+; an investor initiative founded in 2017 that now represents investors with US\$47 trillion in collective assets under management (Climate Action 100+ 2021). The initiative's objectives are to ensure the world's largest emitting companies' have strong climate governance frameworks, take action to reduce emissions in line with the Paris Agreement, and enhance corporate disclosure in line with the recommendations of the TCFD. Climate Action 100+ aims to achieve its objectives by actively engaging with company executives and in some cases through shareholder resolutions.

Climate-related shareholder activism has also risen over the past few years (Allens Linklaters 2020), and has been linked to an increase in the rate of climate risk disclosure by managers (Flammer 2019). Increased investor activism is partially driven by pressure from investors' own shareholders, who are often organised through non-government organisations that act as a proxy on their behalf to bring forward shareholder resolutions, negotiate with management and organise publicity campaigns.

⁴ Scope 1 emissions are direct greenhouse gas emissions that occur from sources that are controlled or owned by an organisation. Scope 2 emissions are indirect greenhouse gas emissions associated with the purchase of electricity, steam, heat, or cooling. Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organisation, but that organisation indirectly impacts in its value chain. Scope 3 emissions include all sources not within an organisation's scope 1 and 2. Scope 3 emission sources include emissions both 'upstream' and 'downstream' of the organisation's activities. One company's upstream emissions are another company's downstream emissions (EPA n.d.).

Box 1.3: The rise of legal duties relating to climate change under Australian law

Director and fiduciary duties:

The expansion of climate-related litigation is forcing directors and trustees to consider how they account for and manage climate-related risks. Although there has not yet been a definitive legal judgment on the specific duties of directors in relation to climate change in Australia, the widely accepted legal view is that climate-related risks are foreseeable, and should therefore be considered by company directors in the execution of their fiduciary duties of care and diligence (Hutley & Hartford Davis 2016). The more a company and its directors are exposed to climate-related risks, the more likely they are to be found to have breached their legal duties.

Failure to consider climate-related risks could result in directors being held personally liable in the event a company incurs losses resulting from foreseeable risks (Hutley & Hartford Davis 2016). This view has been endorsed by the Australian Securities and Investments Commission (ASIC) (Price 2018), and broadly aligns with recent developments in the corporate reporting and disclosure guidance provided by regulators (Appendix 1, Table A1.1).

An April 2021 legal opinion prepared by Noel Hutley SC and Sebastian Hartford Davis suggests that the standard of care to be exercised by directors with respect to climate change continues to rise. Specifically, the barristers considered that companies making net zero commitments would require 'reasonable grounds' to support the express and implied representations contained in those commitments at the time they were made. The opinion warns that it is foreseeable a company (and its directors) could be found to have engaged in misleading or deceptive conduct, among other breaches, for making climate commitments they cannot reasonably achieve (Hutley & Hartford Davis 2021).

Last year, the Retail Employees Superannuation Trust (Rest)—an A\$57 billion pension fund—committed to publicly disclose its full portfolio of holdings, conduct climate scenario analysis to inform its investment strategy and advocate for the companies it invests in to comply with the goals of the Paris Agreement. These commitments were part of a settlement agreement with one of its members, who was alleging that Rest breached the *Superannuation Industry (Supervision) Act 1993* (Cth) and the *Corporations Act 2001* (Cth) by failing to manage climate-related risks (Rest 2020).

While the case did not go to trial and therefore did not establish binding precedent, the final hour settlement is viewed by many in the legal fraternity as a significant development in Australian climate litigation. It is seen as a tacit acknowledgment that climate risks are “material, foreseeable and actionable now” (APRA 2019), which effectively sets a new corporate standard for the exercise of adequate care, skill and diligence in implementing investment strategies, among other things.

Duties on Federal Government actors:

In 2020, a proceeding was filed against the Commonwealth: a class action led by a private Australian citizen, who is alleging that the Australian Government failed to disclose material risks arising from climate change in respect of exchange-traded Australian Government bonds (*O'Donnell v Commonwealth*).

The case's lead applicant seeks a declaration from the Australian Government that it breached its duty of disclosure and deceived and mislead investors, as well as an injunction related to retail bonds that would prevent the Government from issuing ASX-traded retail interests in sovereign bonds until the relevant disclosures are made (Equity Generation Lawyers 2020).

In May 2021, the Australian Federal Court delivered a landmark judgment in a class action case brought on behalf of all Australian children against the Federal Environment Minister. The case concerned the proposed Vickery coal mine extension project in New South Wales. The applicants asserted that the Minister, in the exercise of her powers to approve (or not approve) the project under ss 130(1) and 133 of the *Environment*

Protection and Biodiversity Conservation Act 1999 (Cth), owes Australian children a duty to act with reasonable care so as not to cause them harm.

On this point, the court found in favour of the applicants and held that the Minister is obligated to have “the interests of the children in contemplation when she exercises her power to approve the extraction of coal and its consequential emissions into the atmosphere”. The court considered evidence in the case from the IPCC, the CSIRO, and the Bureau of Meteorology. It found that harm from future climate change is real, catastrophic, and “reasonably foreseeable” (*Sharma v Minister for the Environment*, 2021). The case is currently on appeal to the Full Federal Court.

The regulation of climate-related risk

Four dominant global trends are emerging in the regulation of climate-related financial risk:

- mandatory disclosure and reporting
- standardisation of reporting and the emergence of national climate scenarios
- mainstreaming climate-related risk disclosures in companies’ audited financial statements
- international collaboration and convergence.

This section provides an overview of these trends and discusses their implications for Australia.

Mandatory reporting

Mandatory disclosure and reporting refers to the legal or regulatory obligations that are placed on organisations to provide information about climate-related risks to their operations, strategy and financial planning where such information is material. Mandatory reporting necessitates the development of centralised climate-related disclosure frameworks that are comprehensive and comparable. It is likely to emerge as a key regulatory tool for managing climate risk.

The G7 and the United Nations are now calling on governments around the world to implement mandatory disclosure regimes based on the TCFD framework before COP26—the climate change conference to be held in Glasgow at the end of 2021. The COP26 Private Finance Hub—led by Mark Carney, UN Special Envoy for climate action and finance—will be working with countries and international standard setters in an effort to achieve this in an efficient and effective manner (Carney 2020b).

In Australia, the ASIC and the APRA recognised the TCFD framework as best practice in 2019 and the Corporate Governance Council of the Australian Securities Exchange (ASX) has recommended that all listed companies disclose climate risk in line with the TCFD framework (Armour 2019; Governance Institute of Australia 2020).

There remain concerns over the quality and consistency of TCFD-aligned reporting however, and the TCFD recommendations continue to be developed and refined over time. The standardisation of what is being reported, where and how, is emerging as a key issue for investors, who commonly report that existing TCFD disclosures by companies are inconsistent, lack context, are not comparable and do not deal with the financial implications of climate change (TCFD 2019). It is reasonable to expect that this will change, as companies begin including TCFD-aligned reporting into their financial accounts instead of their sustainability reports, and as climate-related financial disclosure moves further into the reporting mainstream.

Mainstreaming

The incorporation—or mainstreaming—of climate-related disclosures into organisations’ audited financial reports can be mandated by governments or considered best practice by national and international accounting and audit bodies. As discussed in the Authority’s *Prospering in a low-emissions world* report, building climate change disclosure into mainstream financial reporting helps ensure the practice becomes a routine aspect of regular filings, enabling greater transparency and consistency in reporting (CCA 2020).

Efforts to mainstream climate-related reporting are underway at an international level. Most significantly, the International Financial Reporting Standards (IFRS) Foundation—the peak global financial accounting standards umbrella body—has received widespread support following consultations for it to play a role in the development of global sustainability standards (IFRS 2021a), and announced it will create a new board to set IFRS sustainability reporting standards for financial accounting (IFRS 2021b; IFRS 2021c). The standards will focus on rules to integrate climate-related financial disclosures. To date, 140 countries have formally adopted the IFRS’s global accounting standards, including Australia and most of its key trading partners (IFRS n.d.). The IFRS’s standards are issued by the International Accounting Standards Board (IASB), which has already expressly identified climate risks as material risks for the purposes of mainstream financial reporting (Anderson 2019). In June 2021, the G7 finance ministers and central bank governors announced their support for the IFRS’s program of work to develop a baseline standard of reporting in line with the TCFD framework. They also encouraged further consultation on a final proposal leading to the establishment of an ISAB ahead of the COP26 (UK Government 2021).

In Australia, the Australian Accounting Standards Board has recommended the TCFD as best practice and has called for consideration of climate-related risk to be fully integrated into mainstream financial considerations (AASB & AUASB 2019).

Standardised reporting

The standardisation of climate-related reporting involves the creation or endorsement of reporting guidelines, and/or the development of national climate scenarios, to help ensure reporters take a consistent and reliable approach. Climate scenarios are data driven representations of potential climate futures. Different regions face different climate futures, so governments and the private sector have started developing climate scenarios specific to their own regions.

Alongside the expansion of corporate reporting frameworks, standardised tools for assessing and measuring climate risk are being developed. Scenario analysis and science-based targets (SBTs) are gaining traction, especially in TCFD-aligned reporting (TCFD n.d.b; Yan et al. 2020). Organisations can use scenario analysis to model and assess their future vulnerability to climate-related physical and transition risks under different temperature scenarios and decarbonisation pathways, and to help them plan strategically. The Science-based targets initiative (SBTi) has emerged as the leading authority in developing guidance and assessing company targets. It requires that companies measure their scope 1, 2 and 3 emissions and annually disclose their performance against SBTs, with targets considered to be ‘science-based’ if they align with the Paris Agreement’s temperature goals⁵ (Yan et al. 2020).

Globally and within Australia, there is a growing push to accelerate the convergence of major private sector frameworks and tools in corporate climate reporting, with a view to establishing a core set of sustainability disclosure standards (WEF 2020). APRA is in the process of developing a Climate Vulnerability Assessment (CVA) that will use scenario analysis to promote standardised reporting, enabling participating institutions to better understand and proactively address climate-related risks. In September 2021, APRA published an information paper outlining the purpose, design and scope of the CVA, which is being designed in consultation with Australia’s five largest banks as well as other agencies on the Council of Financial Regulators (APRA 2021a). The work aligns with APRA’s policy and supervision priorities for 2021, which include “updating prudential standards on operational risk, governance and risk management, and consulting with industry on guidance for climate change financial risk” (APRA 2021b) (Appendix 1, Table A1.1).

⁵ Scope 3 emissions targets are only required under the SBTi where they represent more than 40 per cent of a company’s overall emissions.

International collaboration

Central banks, treasury departments and financial regulators are growing increasingly concerned about the financial market implications of poorly managed transition risks, as demonstrated by their sharpening focus on regulatory responses to climate change and efforts to collaborate internationally (Appendix 1, Table A1.1 and Box 1.4).

In July 2021, the FSB published a roadmap that sets out a plan, including steps and indicative timeframes, for addressing climate-related financial risk in an internationally coordinated manner. The plan was prepared in consultation with standard setting bodies and other relevant international organisations, and delivered to the G20 Finance Ministers and Central Bank Governors (FSB 2021), who requested in a joint communique that the FSB continue its “work on evaluating the availability of data and data gaps on climate-related financial stability risks, and on ways to improve climate-related disclosures” (G20 Italia 2021a).

Central banks have played an important role in international collaboration efforts to measure and manage climate risk since 2017, when a group of eight central banks and financial supervisors established the Network for Greening the Financial System (NGFS), described as the “least-noticed but potentially most revolutionary initiative in sustainable finance policy” (Barrett & Skarbek 2019). The NGFS’s membership has grown rapidly to reach around 90 central banks and financial supervisors, including the Reserve Bank of Australia, which joined in 2018 (NGFS 2021). APRA also became a member in 2021 (NGFS 2021).

The NGFS’s purpose is “to enhance the role of the financial system to manage risks and mobilize capital for low carbon investments” (NGFS 2019). The NGFS’s work is divided into five work streams, which include:

- a micro prudential/supervision stream that focuses on climate risk disclosure, supervisory practices and financial risk differentials between ‘green’ and other assets
- a macro financial stream that assesses the impact of climate-related risks on the economy and financial system, including through scenario analysis
- a stream that seeks to scale up green finance, including through the adoption of sustainable and responsible principles it into central banks’ own policies and approaches (NGFS 2020b).

The NGFS climate scenarios—which suggest that 3°C+ of warming would result in global GDP being 25 per cent lower in 2100 than in the NGFS baseline scenario (NGFS 2020a)—demonstrate how serious central banks and supervisors consider the economic risks posed by climate change to be. Building on the NGFS scenarios, the Bank of England will become the first regulator to stress test its major banks and insurers against different climate pathways (Carney 2020c; BOE 2021).

Where global collaboration between central banks and financial regulators may lead remains to be seen. They have at their disposal a number of powerful policy levers that could accelerate the decarbonisation of the economy. These include adjusting capital adequacy rules for lending to fossil fuel projects and tilting their own financial asset purchases towards green assets (Barrett & Skarbek 2019; CBI 2019b; Gunningham 2020). However, central banks and regulators also face constraints given their mandates are limited to financial and macroeconomic stability (Gunningham 2020).

Box 1.4: Central banks' policies associated with transition risks

Central bank	Approach to transition risk
Reserve Bank of Australia (RBA)	The RBA monitors climate-related risks as part of its monetary policy and financial stability mandates. This includes working to incorporate potential risks into economic outlooks, assessing evolving risks to financial institutions, and working to improve the quality of information available via the NGFS (RBA 2019). The RBA has flagged addressing climate-related financial risks as a “prominent area of work” over the 2021–22 Financial Year (RBA 2021).
Reserve Bank of New Zealand (RBNZ)	The RBNZ's climate change strategy ensures that climate risks are reflected in the Bank's core functions, including the development of monetary policy, the identification of prudential requirements and the monitoring and assessment of financial markets and stability risks. The Bank has also committed to engage with regulated entities to understand how climate risk is being addressed at a sectoral level, and to play an active role in supporting policy development domestically and internationally (RBNZ n.d.).
Bank of England (BOE)	The BOE is engaging in work to embed climate-related transition risk into its financial decisions and economic analysis, in line with its statutory objective to enhance the resilience of the United Kingdom's financial system to the transition to a low emissions economy. To date, the BOE has focused on the climate risks to the insurance and banking sectors, releasing supervisory and policy statements and stress-testing frameworks designed to assess the resilience of the United Kingdom's largest banks, insurers and financial systems to different climate pathways, and provide a comprehensive review of the United Kingdom financial system's exposure to transition risk (BOE 2021). The United Kingdom was a joint establisher of the NGFS.
European Central Bank (ECB)	The ECB takes climate-related transition risk into account in its macroeconomic modelling, forecasting methods and risk assessments. It also accounts for transition risk in its monetary policy and investment portfolios, in measuring and assessing financial stability, and in its engagement with banks, to ensure they are able to engage effectively in risk measurement and management (ECB n.d.) In July 2021, the ECB published a roadmap to further incorporate climate change considerations into its policy framework (ECB 2021).
People's Bank of China (PBOC)	The PBOC has committed to studying the impact of climate-related risk on the financial sector (Bloomberg 2019), and to enhancing the sector's capacity to analyse and manage transition risk. The PBOC also supports global climate-related risk initiatives, and jointly established the NGFS in 2017 (Gang 2020).
Bank of Korea (BOK)	In its Monetary Policy for 2021 statement, the BOK committed to strengthening its internal research into the effects of climate change on the economy and monetary policy over the medium to long term, which is likely to include a consideration of transition risk (BOK 2021). The BOK is also a member of the NGFS (NGFS 2021).
Bank of Japan (BOJ)	The BOJ has recognised that climate-related risks, including transition risk, are of increasing concern to financial stability, and has highlighted them as one of its key themes for examination this year. Among other things, it will work with the Financial Services Agency to consider how financial risks associated with climate change can be measured (Kihara & Wada 2021). The BOJ has also joined and continues to work with the NGFS (Wakatabe 2019).

Part 1: Investment and finance**The regulation of climate-related risk by Australia and key trade and investment partners**

Australia and many of its key trade and investment partners are regulating climate-related risk by increasing disclosure and reporting obligations, developing new reporting frameworks and nationally consistent climate scenarios, and considering and adopting climate-related risk disclosures as part of national accounting standards. Table A1.1 in Appendix 1 details the actions of Australia and its partners across each of the four trends detailed above. A high-level summary is set out in Table 1.4 below.

Table 1.4: Summary of the status of the regulation of climate-related risk in Australia and its key trade and investment partners

		Mandatory climate-related disclosure	Standardised reporting	Mainstreaming	International collaboration
	Australia	●	●	●	●
	European Union	●	●	●	●
	United Kingdom	●	●	●	●
	Canada	●	—	●	●
	New Zealand	●	●	●	●
	China	●	●	●	●
	Japan	●	●	●	●
	South Korea	●	—	●	●
Key					
 Strong action  Medium action  Low or no action  Unknown					

Notes: Only actions at the federal level (or regional level in the case of the European Union) are captured in this table. There may be stronger or weaker action at the state level (or in the case of the European Union, at the level of individual member countries).

New Zealand and the United Kingdom continue to lead the charge on mandatory climate-related disclosure globally, with both countries having announced that they will implement reporting regimes requiring certain entities, including listed companies and large financial institutions, to produce climate-related disclosures within the next few years in a manner consistent with the TCFD recommendations.

Momentum is also growing in the United States. In January 2021, President Biden signed an executive order recognising that the United States Government “must drive assessment, disclosure, and mitigation of climate pollution and climate-related risks in every sector”, and committing the Treasury Secretary to ensuring that the United States is present and engaged in relevant international fora and institutions working on managing climate-related financial risks (The White House 2021a). The United States expanded on this in a May 2021 executive order, to “advance consistent, clear, intelligible, comparable, and accurate disclosure on climate-related financial risk”. The order sets in motion steps to develop a whole-of-government approach to mitigating climate-related financial risk; encourage financial regulators to assess climate-related financial risk; incorporate climate-related financial risk considerations into federal lending, underwriting and procurement and reduce the risk of climate change to the Federal budget (The White House 2021b).

In mid-2020, the United States Commodity Futures Trading Commission (CFTC) released a significant report on managing climate risk in the United States financial system (CFTC 2020). The report urges financial regulators to “move urgently and decisively to measure, understand, and address these risks”. Following the release of this report and the ushering in of the Biden administration, the United States Treasury announced it will establish a dedicated team focused on climate risks to the financial system (SEC 2021), and the United States Securities and Exchange Commission will review and update climate-related disclosure guidelines—first issued in 2010—for publicly listed companies (Ceres 2020; SEC 2021).

The United States Federal Reserve also joined the NGFS in December 2020 (NGFS 2020c), and has created a new Supervision Climate Committee to “strengthen [its] capacity to identify and assess financial risks from climate change and to develop an appropriate program to ensure the resilience of [its] supervised firms to those risks” (Brainard 2021).

Implications for Australia

In their latest joint report, the Investor Group on Climate Change (IGCC), the CDP and the PRI found that disclosure is “a key element in maintaining the competitiveness of Australian companies with global markets” (IGCC, CDP & PRI 2021). Australia’s attractiveness as a destination for global capital will partly depend on the availability of climate risk-related information, and the extent to which Australian firms benefit or lose from disclosure will depend on the steps they take to protect themselves from climate risk.

Mandatory TCFD-aligned disclosure is emerging in over half of Australia’s top ten two way trading partners, and has already emerged in New Zealand. The development of an IFRS climate disclosure standard that is based on the recommendations of the TCFD will also provide a consistent global reporting standard, which will likely lead to an increase in the number of jurisdictions mandating disclosures.

Accordingly, Australian businesses with an international presence will be asked to meet more extensive and detailed disclosure requirements from customers and authorities in a growing number of key markets. Australian companies that report in line with TCFD will benefit both from ensuring they are actively measuring (and therefore managing) climate risk, and from being aligned with global standards that keep them internationally competitive. The rapidly accelerating pace of uptake between 2017 and 2020 among ASX200 companies is a reflection of this (ACSI 2021).

Major economy sustainable finance plans

Alongside the recognition, reporting and regulation of climate-related risk, a second key driver of low emissions investment is the development and implementation of sustainable finance plans and policies by major economies. This section provides an overview of the sustainable finance plans of Australia’s key trading partners, and their implications for Australia.

Key features of sustainable finance plans

Sustainable finance plans and policies vary from jurisdiction to jurisdiction in terms of their scope, ambition and the policy levers identified to drive action. However, there are several common features, set out in Table 1.5.

The drivers behind these sustainable finance initiatives include:

- the recognition that meeting climate targets will require unprecedented levels of investment in low carbon technologies, services and infrastructure, with private finance central to providing the volume of capital needed
- the desire to strengthen the competitiveness of countries' financial sectors in a decarbonising world
- promoting new economic growth areas in a low emissions economy
- ensuring that climate risks (including physical and transition) to national economies are managed.

Table 1.5: Key features of governments' sustainable finance plans and policies

Feature	Description
Taxonomies	Taxonomies are classification systems that identify which economic activities are environmentally sustainable, including their climate impacts. These systems help investors identify sustainable investment opportunities, and lay the groundwork for further policy action, such as prudential regulation of climate-related risk disclosure or standards and labels (see Box 1.5)
Disclosure of climate risk and prudential regulation	Periodic reporting by companies of information about exposure to climate-related risks, which may involve oversight from regulators. This is usually in line with TCFD recommendations (Section 1.2) and helps investors to take account of the financial risks to companies posed by climate change in investment decisions.
Standards and labels for financial instruments and products	Standards and labels are a set of criteria that need to be met in order for an institution to be able to issue sustainable financial instruments or to market financial products (e.g. equities, loans, bonds) as sustainable. These criteria are often related to the underlying assets being financed, the management and use of proceeds from the financial product and the reporting standards adhered to.
Governance arrangements	Governance arrangements include the establishment of independent bodies or advisory groups to government that oversee the implementation of sustainable finance plans and play a role in policy development.
International engagement and coordination	Countries' international engagement is generally aimed at ensuring alignment with other jurisdictions sustainable finance plans and ensuring that their interests are represented in international discussions. International coordination on sustainable finance occurs through forums such as the International Platform on Sustainable Finance.
Other initiatives to grow low carbon investment	There are a variety of other measures used by countries to overcome barriers and increase flows of low carbon investment, including establishing green finance research centres, changing the mandates of public investment banks, and issuing green bonds.

Sustainable finance plans

The European Union and United Kingdom were early movers on sustainable finance. Both developed comprehensive plans drawing extensively on public and private financial sector experts. One of the most significant developments from the European Union has been the development of a European Union Taxonomy: a classification system that identifies what activities are sustainable, with a focus on climate change mitigation and adaptation (Box 1.5). The United Kingdom is working closely with the European Union on its taxonomy through participating in discussions with the European Union Council (UK Government 2019).

The United Kingdom Green Finance Strategy aims to position the United Kingdom as a green finance hub, given London's existing position as a global financial services destination (UK Government 2019). The United Kingdom Strategy covers international engagement and coordination, with the United Kingdom Government working with governments such as China, Brazil, India and Mexico to develop green finance markets, through the United Kingdom Partnering for Accelerated Climate Transitions programme and the Prosperity Fund (UK Government 2019). The United Kingdom is seeking to incorporate some of the European Union's proposals into United Kingdom law and develop its own internationally relevant standards on sustainable finance through the British Standards Institution.

Canada and New Zealand have both established advisory committees, consisting of private and public financial sector experts, to report on a range of recommendations on sustainable finance initiatives. New Zealand's sustainable finance roadmap recommends, among other things, that standards be created for providing objective definitions of sustainable activities in New Zealand, and that they are harmonised with leading international standards including the European Union Taxonomy (The Aotearoa Circle 2021).

The first recommendation of Canada's report—*Mobilizing Finance for Sustainable Growth*—is to map Canada's long-term path to a low emissions, climate smart economy, sector-by-sector, with an associated capital plan (Government of Canada 2019). Canada, which is a resource-intensive export economy like Australia, notes in its report that the European Union Taxonomy excludes opportunities for emissions reductions arising from technological innovation within the heavy resource and industrial sectors. It concludes that the European Union Taxonomy definitions could exclude some of Canada's core economic sectors from certain investment mandates, benchmark funds and accreditation standards. The Canadian Government has now launched the Sustainable Finance Action Council with the Council to work on progressing the recommendations of the *Mobilising Capital for Sustainable Growth* report including on developing standards for low carbon investments (Government of Canada 2021a).

Several other countries including Japan, China, South Africa and South Korea are also working on initiatives to incorporate sustainability into their financial sectors.

In 2016, the People's Bank of China became the world's first central bank to publish green finance guidelines (PBOC n.d.). The guidelines call for policies and actions in several areas including green bonds, lending and development funds, and markets for pollution control rights (Columbia University n.d.).

In 2019, the UK-China Green Finance Centre, supported by the Green Finance Institute and China's Green Finance Committee, announced that 30 firms from around the world had signed up to a set of green investment principles that aim to incorporate low carbon and sustainable development into projects in Belt and Road Initiative countries—a vast infrastructure building initiative aimed at countries in the neighbouring Asia-Pacific region (City of London 2019). Singapore—a major financial hub for investment into Australia—has recently moved to launch several initiatives to accelerate sustainable finance including issuing a framework to help banks assess eligible green trade finance transactions (MAS 2021).

In Australia, representatives from across the private finance sector established the Australian Sustainable Finance Initiative (ASFI) to deliver a comprehensive sustainable finance roadmap, which was released in November 2020 (ASFI 2020). The recommendations in the Roadmap set out a series of actions for implementation in the short (2021–2022), medium (2023–2025) and long-term (2026–2030), with all actions to be implemented by 2030. Many of the actions mirror the recommendations of other sustainable finance plans, including developing TCFD reporting guidance, embedding sustainability into regulatory guidance and standards, building skills and capabilities and establishing a taxonomy project.

Table A1.2 in Appendix 1 details the main features of the sustainable finance policies and plans of Australia and its key trade and investment partners. A high level summary is set out in Table 1.6.

Part 1: Investment and finance

Table 1.6: Summary of the main features of the sustainable finance policies and plans of Australia and key trade and investment partners⁶

		Taxonomies	Standards and labels	Governance arrangements	International engagement and coordination	Other initiatives
	Australia	—	—	—		
	European Union					
	United Kingdom					
	Canada					
	New Zealand					
	China					
	Japan	—				
	South Korea					
Key						
			In progress (advanced stage)			No policy or progress
			In progress/partly implemented (early stage)		—	Policy not endorsed by Government

Source: See Appendix 1 for sources and further details of key features of country sustainable finance policies and plans.

⁶ Table 1.6 excludes the regulation of climate-related financial risk, which is set out in Table 1.4.

Box 1.5: The European Union Taxonomy

The European Union has outlined a comprehensive sustainable finance policy agenda and is pushing forward with several major initiatives from its 2018 action plan on sustainable finance (European Commission 2018). Among the most significant is the development of a European Union classification system: the European Union Taxonomy, which identifies what activities are sustainable, with a focus on climate change mitigation and adaptation.

The European Union Taxonomy is a tool designed to help advance the European Union's environmental objectives, particularly the targets of net zero emissions by 2050 and a 50–55 per cent emissions reduction by 2030 (EU Technical Expert Group on Sustainable Finance 2020).

To be aligned with the European Union Taxonomy, an economic activity needs to make a substantial contribution to one of six environmental objectives, avoid significant harm to the other five, and meet minimum safeguards. The six environmental objectives are:

- climate change mitigation
- climate change adaptation
- sustainable protection of water and marine resources
- transition to a circular economy
- pollution prevention and control
- protection and restoration of biodiversity and ecosystems.

The Taxonomy regulations set out a broad framework for evaluating whether an economic activity makes a substantial contribution to climate mitigation. For activities where there are no technologically or economically feasible low carbon alternatives, activities must have emissions levels that correspond to best performance for that sector or industry; not hamper the development of low carbon alternatives; and not lead to lock-in of carbon intensive assets (EU Technical Expert Group on Sustainable Finance 2020). This provision for transition activities does not however extend to energy from solid fossil fuels (e.g. coal) which the enabling Taxonomy regulation specifically excludes.

To identify whether a specific activity meets these criteria, the European Union's technical working group has developed technical screening criteria for specific industries: agriculture, energy, manufacturing, transport, water and waste, information and communication technology, and buildings. For example, for energy, the Taxonomy sets the emissions intensity threshold at 100g CO₂-e/kWh reducing in five-year increments to 0g CO₂-e/kWh by 2050.

Financial market participants will be required to disclose how their activities align with the Taxonomy's criteria for climate mitigation and adaption by the end of 2021. Large companies will begin disclosing in 2022. Amongst other things, investors will need to report on what proportion of their investments are aligned with the Taxonomy, while companies will need to make similar disclosures for the proportion of turnover and expenditure.

Under the Biden administration, the United States is expected to ramp up policies that would unlock sustainable development finance. United States Treasury Secretary Janet Yellen has been tasked with writing a national climate finance plan (The White House 2021c). The plan includes responding to the demands of financial markets to help them identify climate-aligned investments. President Biden's recent executive order on climate-related financial risk also includes tasking the National Climate Advisor and the Director of the National Economic Council to identify the public and private financing needed to reach economy-wide net zero emissions by 2050 (The White House 2021b).

International convergence

Similar to the regulation of climate-related risk, there is a global shift towards the convergence of key sustainable finance policies and mechanisms. Under China's G20 Presidency in 2016, the Green Finance Study Group was launched to identify institutional and market barriers to green finance and, based on country experiences, develop options for enhancing the ability of financial systems to mobilise private capital for green investment (UNEP 2016). In 2018, under Argentina's Presidency, the Green Finance Study Group was renamed the Sustainable Finance Study Group. The Sustainable Finance Study Group is also taking into account sustainability co-benefits such as job creation and income equality.

The Sustainable Finance Study Group has recently been re-established, with the G20 Finance Ministers and Central Bank Governors agreeing to elevate it to a G20 working group. Its first objective is to take stock of existing international work on sustainable finance and charter a roadmap for a collective way forward (G20 2021). The G7 Finance Ministers and Central Bank Governors have supported the development of the roadmap in a communique that calls for the convergence and harmonisation of sustainability standards (UK Government 2021).

Global cooperation on sustainable finance policy is also taking shape through the International Platform on Sustainable Finance (IPSF), launched in 2019 (European Commission n.d.b). IPSF participants represent economies that generate over 50 per cent of global GDP, including the European Union, United Kingdom, Canada, China, India, Japan, Singapore, New Zealand and Indonesia. The forum is working to promote best practice and exchange information, helping members to compare their different initiatives and identify barriers and opportunities. Willing members can further strive to coordinate and align their initiatives and approaches, where appropriate, on a range of sustainable finance topics including classification systems (i.e. taxonomies), climate-related risk disclosure and standards and labels (IPSF 2020).

In April 2021, China's central bank, the PBOC, revealed that it is co-operating with the European Union to harmonise green investment taxonomies across the two markets (Li & Yu, 2021). The Governor of the People's Bank of China PBOC reportedly stated that the primary goal of the central bank over the next five years was to implement and standardise a green finance system in the country in co-ordination with global partners.

Implications for Australia

The European Union's Taxonomy will be an early test case for the implications of sustainable finance plans for Australia as a recipient of foreign investment. The European Union Taxonomy and related disclosure requirements are likely to encourage investors and companies to seek foreign investment opportunities that align with the European Union's domestic climate targets (Box 1.5). The European Union is Australia's second largest source of foreign investment after the United States (Table 1.1).

In a written submission to the European Commission, the Minerals Council of Australia expressed concern that the European Union Taxonomy's treatment of nuclear power and carbon capture utilisation and storage (CCUS) are more onerous than for energy sources such as wind and solar, and that the taxonomy will have "broad-ranging investment-impacts... not just within the European Union but anywhere European Union-based firms invest" (MCA 2020).

A globalised set of rules for sustainable finance—or the adoption of the European Union model by other major economies—would have even more significant implications for Australia's ability to attract foreign investment. Australia's participation in international discussions on sustainable finance remains limited and it is currently not a member of the IPSF. However, if Australia chose to engage it could potentially influence how sustainable finance rules should be applied in areas where it has extensive expertise and a competitive advantage, such as the mining sector.

Government investment to leverage private investment

Direct government investment in low emissions activities, often directed at catalysing further investment from the private sector, is a third key driver of low carbon investment.

On a decarbonisation trajectory aligned with the Paris Agreement, private sources of capital would provide more than 70 per cent of clean energy and electricity network investment (IEA 2020c). However, government investment will be critical to attracting this investment and giving momentum to the energy transition (IEA 2020c). Government investment is particularly important in areas where market failures exist, such as in basic research and development where private benefits from investment are difficult to capture (Goulder 2004; CCA 2020).

The COVID-19 pandemic has provided governments with an opportunity to reorientate economic activity given the need for significant public expenditure. A number of countries are using COVID-19 recovery packages to decarbonise their energy sectors and position themselves to attract low emissions investment moving forward. Strategic investment by governments in low carbon sectors, when appropriately designed and targeted, can change the risk-return profile of investments and help attract finance from the private sector.

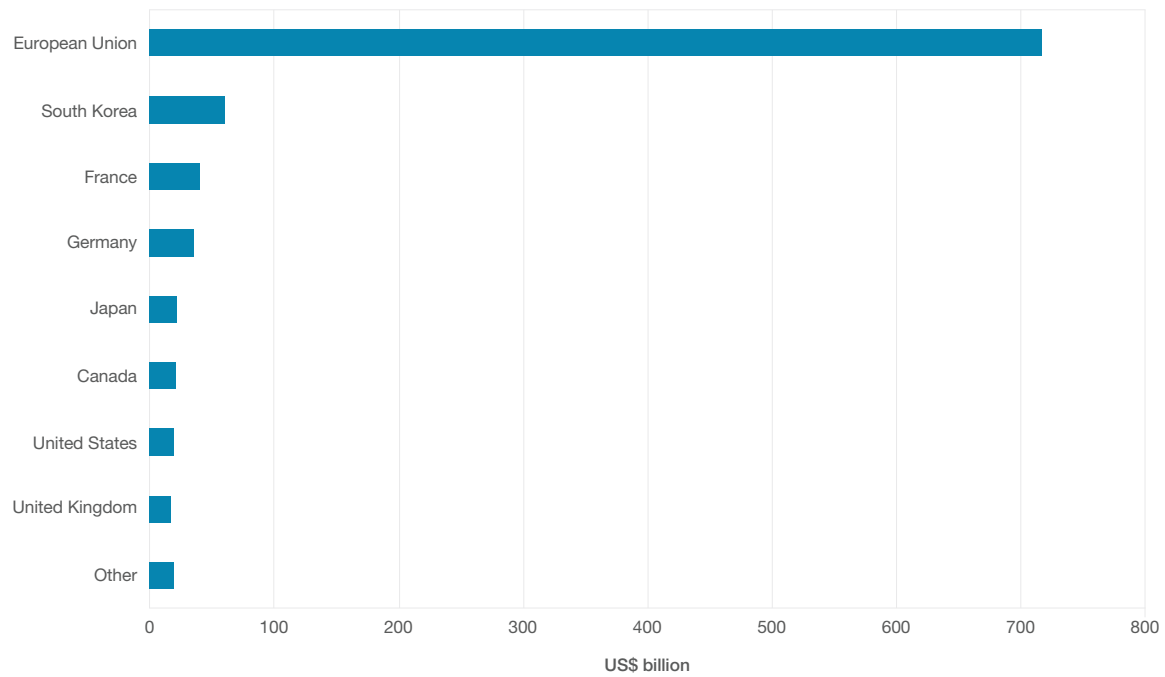
BloombergNEF estimates that as of 15 March 2021, the total approved stimulus directed at the low emissions economy globally stood at US\$949 billion (BloombergNEF 2021d) (Figure 1.7). Stimulus directed at incumbent industries was slightly higher, at US\$1.15 trillion. 85 per cent of the US\$14 trillion of COVID-19 stimulus approved to date has been categorised by energy analysts BloombergNEF as 'neutral'.

The European Union's Next Generation recovery package includes a strong emphasis on green recovery, in line with the European Union Green New Deal. The recovery package along with the European Union's long term budget will deliver at least US\$717 billion of green stimulus funding (Figure 1.7).

Stimulus packages with a strong emphasis on low emitting sectors have also been announced in South Korea, France, Germany, Canada and the United Kingdom. The United Kingdom's ten point plan aims to lay the foundation for a green industrial revolution by targeting opportunities in hydrogen, CCUS, zero emissions vehicles and green finance, amongst others (BEIS 2020). The United Kingdom's ten point plan entails £12 billion of government investment and aims to mobilise three times as much from the private sector, to create and support up to 250,000 green jobs.

The policy direction of the Biden administration in the United States will likely see further funding channelled into low emissions sectors. The United States Senate has passed a US\$1.2 trillion Bipartisan Infrastructure Package, which, if passed by the House of Representatives in its current form, would see significant government investment in clean energy transmission, CCS, hydrogen and electric vehicle (EV) charging infrastructure (The White House 2021d). President Biden has also committed to setting a target to make half of all new vehicles sold in the United States by 2030 net zero emissions vehicles, including battery EVs, plug-in hybrid and fuel cell EVs (The White House 2021e).

Figure 1.7: Approved green stimulus



Source: BloombergNEF 2021d.

1.3 The future of low carbon investment

Achieving a low emissions global economy will entail a major reorientation of energy investment away from carbon intensive forms of energy towards low carbon technologies and electricity networks. Mobilising the capital required to achieve this transformation over the next 30 to 50 years will require overcoming significant technical, political, economic and regulatory challenges. Table 1.7 sets out a number of different scenarios for the future of the global energy system as presented by the IEA and BloombergNEF.

Table 1.7: International Energy Agency and BloombergNEF climate and energy scenarios

Scenario	Author	Description
Sustainable Development Scenario	IEA	This scenario sees countries take action to hold the rise in global average temperatures to well below 2°C. The emissions trajectory in this scenario is consistent with reaching net zero CO ₂ emissions in 2070. If net emissions stay at zero after this point, there is a 66 per cent chance of limiting the global average temperature rise to 1.8°C above pre-industrial levels (or a 50 per cent chance of a 1.65°C stabilisation).
Stated Policies Scenario	IEA	This scenario incorporates the effect of announced policy ambitions and targets as of mid-2020, including Nationally Determined Contributions under the Paris Agreement. Recent net zero announcements by major Asian economies are not incorporated. The emissions trajectory mapped in this scenario is consistent with a 66 per cent probability of limiting global temperature increases to 3.2°C above pre-industrial averages, or to below 2.7°C with a 50 per cent probability.
Net-Zero by 2050 Scenario	IEA	This scenario sees the world achieve net zero CO ₂ emissions by 2050, and also minimise methane emissions. The scenario is consistent with around a 50 per cent chance of limiting the long term average global temperature rise to 1.5°C without a temperature overshoot.
Economic Transition Scenario	BloombergNEF	This scenario focuses on the economic fundamentals of the energy transition, setting aside climate targets and aspirational national energy policies. It assumes an average global temperature increase of 3.3°C.
NEO Climate Scenario 2020	BloombergNEF	This scenario maps a pathway to reduce emissions that is consistent with a 67 per cent chance of limiting warming to 1.75°C. In 2020, this scenario focuses on a clean electricity and hydrogen pathway.
New Energy Outlook 2021	BloombergNEF	This report outlines three distinct scenarios for achieving net zero emissions by 2050, consistent with 1.75°C of warming by 2100. A “green scenario” (renewable electricity, bioenergy, green hydrogen); a “gray scenario” (renewable electricity, some fossil fuels with CCS technologies); and a “red scenario” (small modular nuclear, renewable electricity and battery storage, dedicated nuclear plants for manufacturing ‘red’ hydrogen).

Source: IEA 2019a; IEA 2020c; BloombergNEF 2020; BloombergNEF 2021e

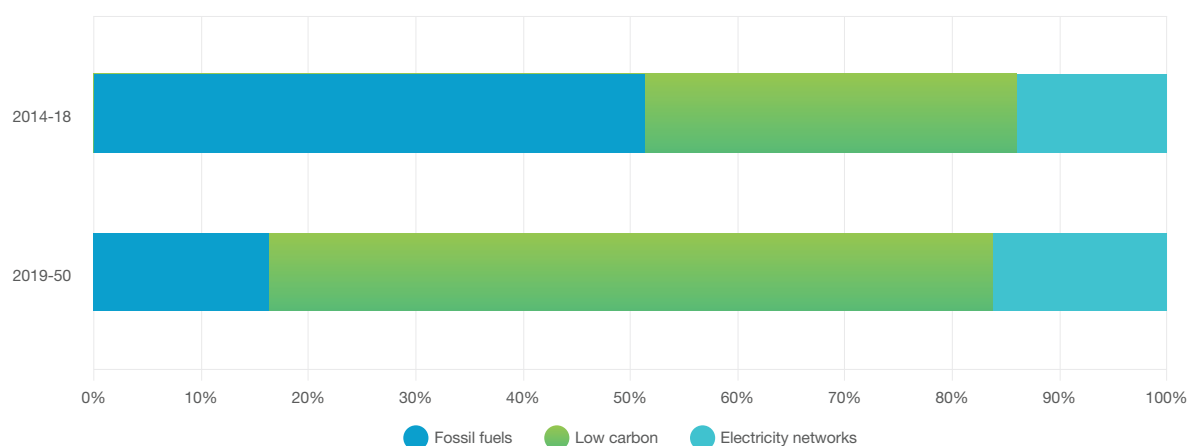
Notes: These scenarios focus on energy sector emissions.

IEA Sustainable Development Scenario

The IEA Sustainable Development Scenario maps energy investment flows under an emissions trajectory consistent with holding global average temperature rises to well below 2°C, in line with the Paris Agreement (Table 1.7) (IEA 2019a).

Figure 1.8 shows how the composition of global energy investment shifts markedly in the Sustainable Development Scenario. Low carbon investment constitutes almost 70 per cent of world energy investment over the next three decades, while fossil fuel investment falls to just 16 per cent.⁷

Figure 1.8: Shares of average annual global energy investment, IEA Sustainable Development Scenario



Source: IEA 2019b.

Under the Sustainable Development Scenario, average annual investment in fossil fuels falls by almost 50 per cent over the next three decades to 2050, from around US\$1.1 trillion (over the period 2014 to 2018) to less than US\$600 billion (Figure 1.9).

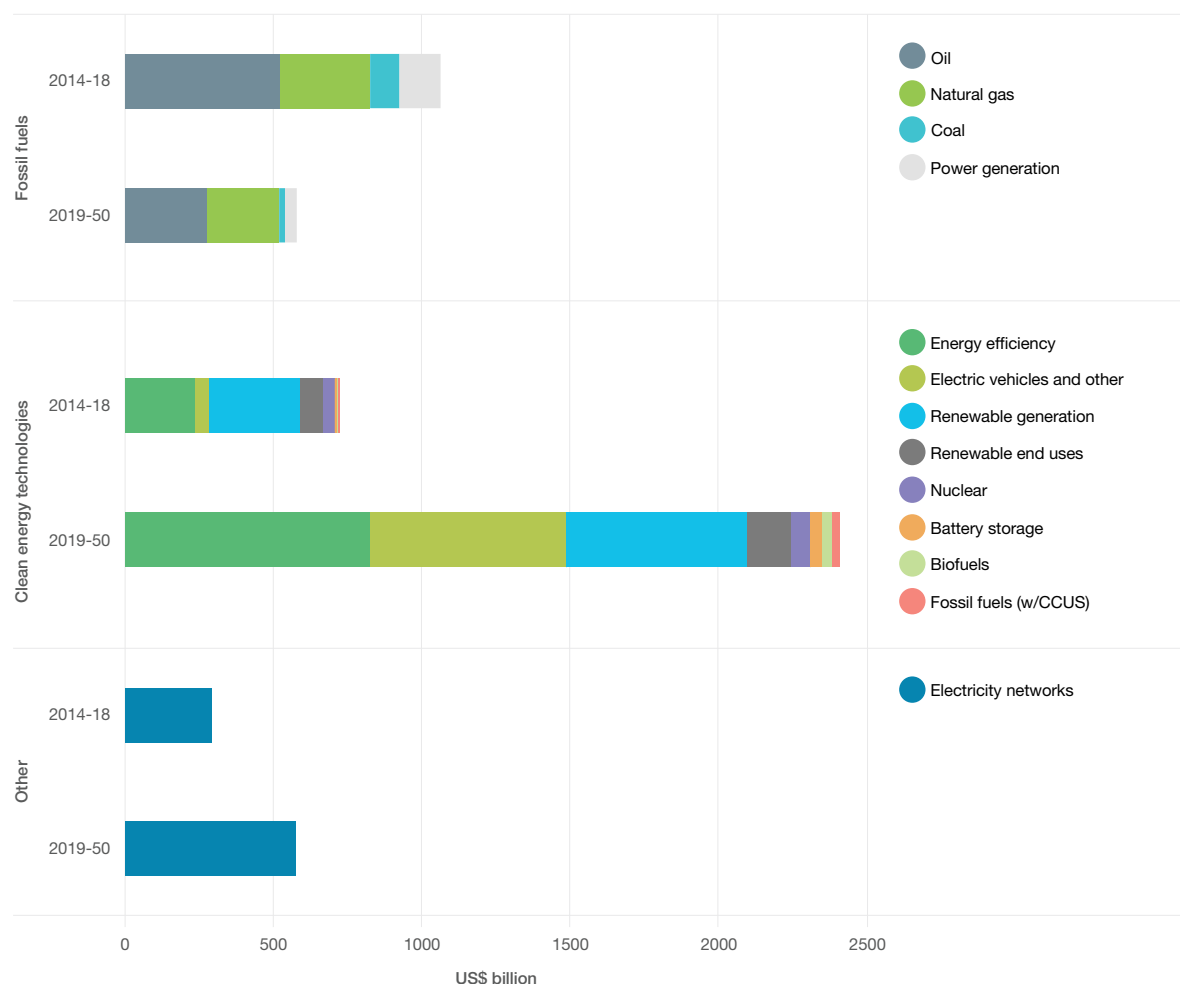
In contrast, investment in low carbon technologies grows rapidly in the Sustainable Development Scenario. Annual investment in low carbon technologies more than triples to reach US\$2.4 trillion a year over the period to 2050:

- investment in energy efficiency triples to over US\$800 billion per annum
- investment in EVs and charging infrastructure increases 14-fold to around US\$660 billion a year
- investment in renewable power generation doubles from around US\$300 billion to US\$600 billion a year
- nuclear energy investment increases, rising by around 50 per cent to around US\$70 billion each year
- battery storage, biofuels and fossil fuels with CCUS—just a small fraction of global energy investment today— attract a combined total of over US\$90 billion of investment a year over the next three decades.

Investments in electricity networks would also need to grow rapidly to facilitate the electrification of transport and industry, with average annual investment between 2019 and 2050 doubling on current levels.

⁷ Low carbon investment includes investment in energy efficiency, electric vehicle charging infrastructure and incremental spending on electric vehicles, CCUS in industry, renewable generation, renewable end uses, nuclear, battery storage, biofuels, and fossil fuels with CCUS. Investment in electricity networks is excluded.

Figure 1.9: Average annual global energy investment, IEA Sustainable Development Scenario



Source: IEA 2019a.

Notes: 'Electric vehicles and other' includes incremental spending on electric vehicles (i.e. the additional cost of an electric vehicle relative to an internal combustion engine vehicle of the same class), electric vehicle charging infrastructure and CCUS in industry.

Other decarbonisation scenarios

More rapid decarbonisation scenarios—where global temperature increases are limited to 1.5°C—will require a more rapid redeployment of capital from high to low emitting activities. Under the IEA's Net-Zero Emissions by 2050 Scenario, low carbon investment would need to more than triple by 2050, while investment in fossil fuel supply in 2050 would be just over a fifth of the level seen over the past few years (IEA 2021a).⁸ Investment in frontier technologies like CCUS and hydrogen expands rapidly from just a few billion a year today to around US\$160 billion and US\$470 billion respectively in 2050. In June 2021, G7 leaders explicitly noted the IEA's net zero pathway in their collective commitment to lead a "technology-driven transition to net-zero, supported by relevant policies" (G7 leaders 2021).

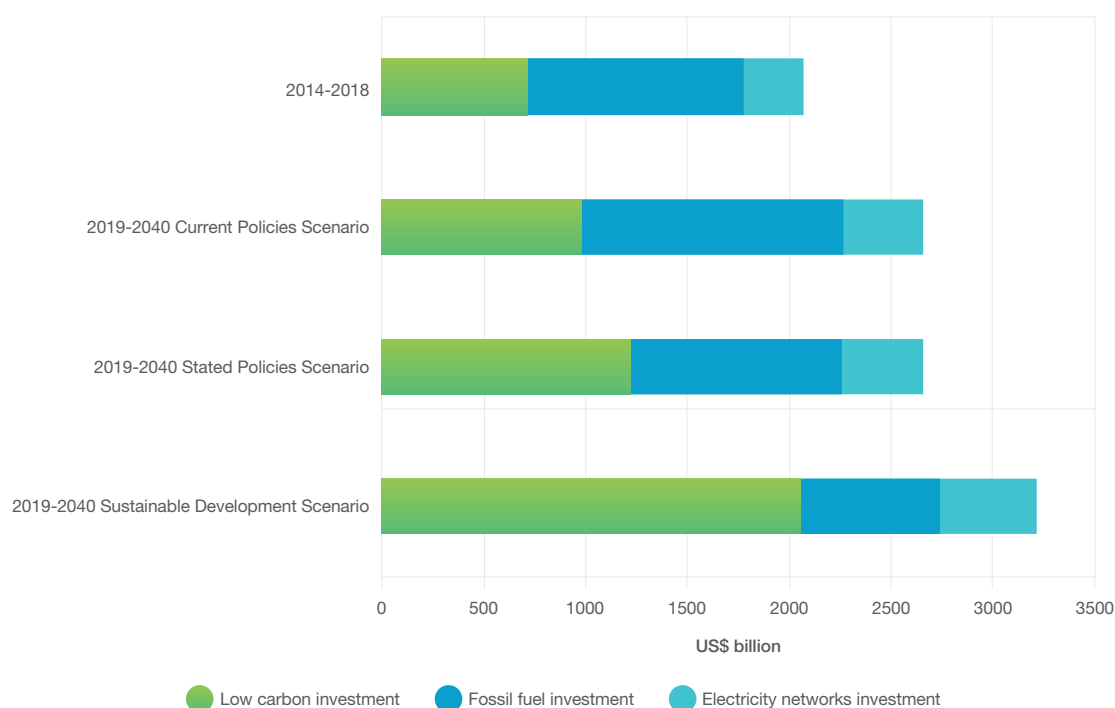
⁸ The value of low carbon investment differs substantially between the IEA's Net-Zero by 2050 Scenario and the IEA's Sustainable Development Scenario / World Energy Investment report, partly for methodological reasons.

Similarly, in its New Energy Outlook 2021, BloombergNEF estimates that reaching net zero emissions by 2050 will require between US\$92 trillion and US\$173 trillion of global investment in energy supply and infrastructure, rising from US\$1.7 trillion per year at present to somewhere between US\$3.1–5.8 trillion a year on average for the next three decades (BloombergNEF 2021e).

Under gradual decarbonisation scenarios where Paris Agreement targets are missed, low carbon investment is still set to grow substantially. The IEA's Stated Policies Scenario maps a gradual transition to a low carbon future, with global warming of around 3°C (Table 1.7)—a scenario that would likely have dire physical, social and economic consequences. Under the Stated Policies Scenario, low carbon investment doubles on 2019 levels—lifting to average around US\$1.2 billion a year to 2040 (Figure 1.10)—primarily driven by investments in energy efficiency and other end uses. Even under the IEA's Current Policies Scenario—which entails little action to curb global warming—low carbon investment climbs to close to US\$1 billion a year for the next 20 years.

A key driver of growing low carbon investment is the changing economics of energy markets. BloombergNEF's Economic Transition Scenario (Table 1.7)—which assumes 3.3°C of warming by the end of the century—maps future energy investment based only on the economic fundamentals of the energy transition, setting aside climate targets and aspirational national energy policies (BloombergNEF 2020). It finds that wind, solar, pumped hydro, other renewables and nuclear account for 84 per cent of future investment in all new capacity in the power sector over the next three decades, while coal, oil and gas only account for 16 per cent (BloombergNEF 2020).

Figure 1.10: Annual average global energy investment from 2014-2018 and to 2040 under different IEA scenarios



Source: IEA 2019b.

As discussed in Part 3, the reorientation in global energy investment is likely to raise challenges for Australia's high emitting export sectors, but also presents opportunities for the expansion of low emissions industries. The challenges and opportunities of the energy transition are particularly pronounced for Australia because of its reliance on foreign investment and trade.

Investment trends and drivers in the agriculture and land sectors

Like in the energy sector, low emissions investment in the agriculture and land sectors is set to grow rapidly in coming decades. There are a number of interlinked drivers of this trend. The first is the need to reduce emissions from the two sectors, which account for approximately 23 per cent of total anthropogenic emissions (IPCC 2020). There is also increasing recognition of the potential contribution of these sectors to climate change mitigation through acting as a carbon sink. The sequestration of carbon in soil and vegetation is being utilised to not only reduce emissions from agricultural production but is also increasingly being sold as offsets (carbon credits) via carbon crediting mechanisms (e.g. the Emissions Reduction Fund) to companies in other industries to offset their emissions (see Section 3.5) (SMH 2020).

Another imperative is the need to manage the physical risks posed by climate change to agricultural production. The agricultural sector is highly exposed to climate change through both acute (e.g. flooding and droughts) and chronic (e.g. sea level rises and longer-term shifts in rainfall and temperature). According to the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), changes in the climate since the year 2000 have reduced average broadacre farm profits by 22 per cent and the profits of beef farms by five per cent (Hughes, Galeano & Hatfield-Dodds 2019). While future climate change impacts remain uncertain, estimates from a range of global circulation models suggest that future changes to the climate will further reduce the profitability of Australian farms (Hughes 2021). Investment in adaptation will also increasingly be required to build the sector's resilience to future climate impacts.

Investors and lenders are considering climate-related risks to the agriculture and land sectors. For example, in 2019 the Commonwealth Bank—a significant lender to Australian farmers with around 40 per cent of the bank's lending portfolio dedicated to agriculture—commissioned scenario analyses of farm productivity based on a range of potential climate conditions to 2060. Analysis of the grains, livestock and dairy sectors found that many regions face significant risks to farm profitability. The bank said it will use the information to inform future management around its agriculture portfolio, including investing in better tools to monitor and manage risks (CBA Annual Report 2019).

There is also a growing trend for companies to recognise and report on their impacts on the environment and reliance on natural resources. The United Nations Environment Programme Finance Initiative and the United Nations Development Programme, together with Global Canopy and the World Wide Fund for Nature, recently founded the Task Force on Nature-related Financial Disclosures (TNFD). A long list of leading financial institutions such as Credit Suisse (Switzerland), Wells Fargo (United States) and Lloyd's Banking Group (United Kingdom), resources companies such as Rio Tinto and BP, and government bodies are informal working group members. The G7 Finance Ministers welcomed the TNFD's establishment, committing to "properly embed climate change and biodiversity loss considerations into economic and financial decision-making" (UK Government 2021).

The TNFD plans to develop a reporting framework over the next two years to 2022 that will enable financial institutions to better understand their risks, dependencies and impacts on nature. The intention of the TNFD is to operate alongside the Taskforce on Climate-related Financial Disclosures (TCFD), taking a broader approach to risk management. In Australia the ASFI roadmap recommends that the Australian finance sector play a leadership role in the development of the TNFD, fund research that supports TNFD guidance, and that sustainability reporting should become mandatory for listed entities in the medium term (2022-2025) (ASFI 2020).

Part 1: Investment and finance

Investment in the agriculture and land sectors is often linked to broader environmental considerations. Several major green investment funds and initiatives targeting environmental and land use activities were recently launched to increase investment in natural capital and climate solutions. The Earth Charter (or Terra Carta), announced by Prince Charles of England, aims to ensure big businesses are supporting international agreements on the climate, biodiversity and desertification and back efforts to ensure up to 50 per cent of the earth's natural systems are conserved. The new charter is supported by several businesses including AstraZeneca, the Bank of America, BP, HSBC and Heathrow airport. One of its actions is the creation of the Natural Capital Investment alliance, which aims to create a US\$10 billion fund by 2022. Similarly, a partnership between HSBC Global Asset Management and Pollination Group was recently established to create the world's largest dedicated natural capital assets management company.

Part 2: International trade and climate policy

Key findings

The world's largest economies, including some of Australia's key trading partners, are considering using trade to drive global decarbonisation. Trade policy is increasingly being seen as a vehicle for climate action. Carbon border adjustment mechanisms (CBAMs), measures to limit methane leakage, emissions certification schemes and the use of climate provisions in free trade and international investment agreements are all being contemplated or implemented. These actions by governments add to the growing push from markets and consumers for companies to disclose their supply chain emissions and certify the carbon content of their products.

Sectors with high levels of embedded emissions in countries without ambitious climate policies could be the subject of CBAMs—taxes on the carbon content of their exports—with the proceeds of CBAMs likely to flow to importing countries. The European Union is developing a CBAM and the United States is also considering proposals, while the United Kingdom is considering using its G7 presidency to put such measures on the G7 agenda. If implemented, CBAMs would have important implications for global trade flows and the relative competitiveness of different countries and industries.

Measures to limit methane leakage are being considered. The European Union and the United States have launched the Global Methane Pledge, an initiative to reduce methane emissions and improve methodologies for quantifying methane emissions. The European Union is also looking to team up with the world's largest importers of fossil fuels in Asia to measure and verify methane emissions along fossil fuel supply chains. Methane emissions from supply chains for natural gas—Australia's third largest export—are a focus of this work.

Emissions certification schemes have emerged and will proliferate. Emissions certification schemes provide a standardised process for measuring and certifying the emissions associated with particular products along supply chains. A number of schemes are already under development or active for products like hydrogen, aluminium and steel. The design of such schemes will have implications for trade competitiveness.

Free trade and international investment agreements could increasingly include climate provisions. Historically, climate change has rarely featured in free trade agreements, however climate change provisions have been incorporated in some recent agreements.

The new and evolving rules of low emissions trade will be a key determinant of trade competitiveness. As such, countries that are active in shaping the future rules of low carbon trade are likely to gain a competitive advantage.

The world's largest economies, and seven of Australia's top 10 major trading partners representing over half of the world's emissions (ClimateWatch 2021), have now set a mid-century net zero emissions target: the United States, China (2060), the European Union, Japan, the United Kingdom, South Korea and New Zealand (Table 2.1). Trade policies are actively being considered by these economies to help drive progress to net zero emissions. A global trade regime aligned with net zero emissions would have implications for the relative competitiveness of countries and industries, including both Australia's high and low emitting industries.

Part 2: International trade and climate policy

Part 2 of this report identifies the emerging trends in international trade policy, examining the possible emergence of CBAMs, existing and emerging emissions certification schemes, the inclusion of climate considerations in trade agreements and longer term possibilities like global carbon clubs. Shaping emerging trade rules will be critical if Australia is to manage the risks and capitalise on the opportunities of a decarbonising world.

Table 2.1: Australia's major two-way trade partners and net zero targets, 2019–20

	Mid-century net zero target	Trade with Australia, A\$ billion	Share of total, %	Top three goods exports to market
1) China	2060	251,073	29	Iron ore & concentrates, Natural gas, Coal
2) Japan	2050	80,758	9	Natural gas, Coal, Iron ore & concentrates
3) United States	2050	79,113	9	Gold, Beef, Pharmaceutical products
4) European Union	2050	78,697	9	Coal, Pharmaceutical products, Gold
5) South Korea	2050	38,890	4	Iron ore & concentrates, Coal, Natural gas
6) United Kingdom	2050	36,677	4	Gold, Lead, Alcoholic beverages
7) Singapore	-	31,280	4	Gold, Crude petroleum, Natural gas
8) New Zealand	2050	28,653	3	Telecom equipment & parts, Computers, Special transactions & commodities
9) India	-	26,227	3	Coal, Copper ores & concentrates, Natural gas
10) Malaysia	-	21,774	2	Natural gas, Crude petroleum, Coal
<i>Net zero major partners</i>	-	593,862	68	<i>Iron ore & concentrates, Natural gas, Coal</i>
<i>Non net zero major partners</i>	-	79,281	9	<i>Coal, Natural gas, Crude petroleum</i>
<i>Other partners</i>	-	200,002	23	-
Total	-	873,145	100	-

Source: DFAT 2020a; DFAT 2021a.

Notes: Singapore has a view to achieve net zero emissions “as soon as viable in the second half of the century”. A number of countries outside Australia's top 10 trading partners have also net zero mid-century targets. Figures may not sum due to rounding.

2.1 Trends in trade policy

World trade as a percentage of global GDP has grown from around 27 per cent in the early 1970s to just over 60 per cent in 2019 (World Bank 2019). On one estimate, the emissions embedded in traded goods account for close to 40 per cent of global emissions (Barrett et al. 2013). If the goals of the Paris Agreement are to be achieved, trade in high emissions products will need to be replaced rapidly with trade in low emissions products (Ricardo Energy & Environment 2017).

Major economies are developing and implementing trade policy instruments to help achieve net zero emissions. The global trading system could soon feature several interrelated trade policy measures to promote trade and investment in low carbon goods and services, including CBAMs, measures to limit methane leakage, internationally compatible emission certification schemes, and the increased use of free trade and international investment agreements.

Carbon border adjustment mechanisms (CBAMs)

CBAMs—also known as carbon border tariffs or carbon border taxes—could emerge as a key feature of global trade in coming years. Several major economies with strong domestic climate targets, including the European Union, the United States and Canada are considering using CBAMs to level the playing fields for their domestic industries.

As some countries increase their ambition to reduce emissions, the risk of domestic demand shifting to cheaper imported products from countries with weaker climate policies increases. ‘Carbon leakage’—the term used to refer to this phenomenon—occurs when economic production increases in countries with weaker climate change policies leading to more emissions in those countries, and potentially offsetting the emissions reductions impacts of more ambitious domestic efforts (Brandi 2017).

Many countries have tried to address leakage through a suite of domestic policies; for example, by allocating free emissions permits in an emissions trading scheme (ETS) to producers who emit greenhouse gases, or by exempting certain domestic emitters from mitigation action. However, there is evidence that these ‘behind the border’ policies have weakened overall mitigation efforts and, in some cases, led to individual companies making windfall profits at the public’s expense because they have been allocated excess permits which can then be sold (Carbon Market Watch 2016). Some countries are now seeking other ways to address the issue of carbon leakage, including policies like CBAMs (Dröge et al. 2018).

CBAMs address carbon leakage ‘at the border’, either by ensuring imports are subject to the same carbon price as goods produced locally or by compensating domestic exporters (Mehling et al. 2017; Brandi 2017). An importing country with a carbon tax in place may levy a tariff on an imported good equivalent to the carbon tax liability that would have applied if the good had been produced domestically. In the case of an emissions trading scheme, CBAMs might require either domestic importers or foreign exporters to pay a carbon price equal to those required of domestic producers, with the proceeds likely going to the importing country or jurisdiction.

Key design issues

The methodology for calculating carbon border adjustments is a key consideration in the design of CBAMs. Adjustments could be applied purely on the basis of whether or not a product is subject to a comparable domestic carbon price in the exporting country, or they could be based on the amount of carbon used in making and shipping each product: the so-called ‘embedded carbon’ emitted during the production process. It could also be a combination of these approaches.

Calculating the amount of carbon embedded in a particular product is a complex process, with many imports made up of different materials and delivered via difficult to trace supply chains. Each component of an imported product will contain varying degrees of embedded carbon. A CBAM would potentially need to identify the carbon emitted at each stage of the supply chain and by each producer, in order to ensure low emitting producers are not unfairly penalised (The Economist Intelligence Unit 2019).

If implemented, CBAMs will have important implications for global trade flows and the relative competitiveness of different countries and industries. The impacts of CBAMs on trade competitiveness will depend on which industries and goods are subject to CBAMs, and whether or how the emissions embedded in imports are calculated.

The precise impact of CBAMs will depend on how they are finally implemented, meaning that the countries that influence how these mechanisms are designed will likely benefit.

CBAMs in practice

Efforts to implement CBAMs are most advanced in the European Union, where plans are in motion to introduce a CBAM from 2023. In July 2021, the European Commission adopted a proposal for a CBAM as part of the European Green Deal (European Commission 2021a; European Commission n.d.a). According to the Commission, the European Union's CBAM will:

- be designed to prevent the risk of carbon leakage and support the EU's increased ambition on climate mitigation
- comply with the World Trade Organization rules and the EU's other international obligations
- apply initially to sectors with a high risk of carbon leakage and high carbon emissions, namely: imports of cement, iron and steel, aluminium, fertilisers and electricity
- only cover greenhouse gases emitted directly, that is, during the production of the covered goods
- be levied in principle on all imports of covered goods from non-EU countries, however "certain third countries who participate in the Emissions Trading Scheme or have an emission trading system linked to the Union's will be excluded from the mechanism".

The Biden Administration's election platform included a commitment to impose a CBAM on imports from countries failing to meet their climate and environmental obligations (Biden 2020). In March 2021, the Office of the United States Trade Representative confirmed that the Biden administration would consider carbon border adjustments as part of its broader trade agenda (Office of the United States Trade Representative 2021).

Unlike the European Union, the United States does not have a comprehensive domestic carbon pricing system on which to base the calculation of carbon border adjustments, although there are regional carbon pricing systems in place in some states, and federal agencies are mandated to include a social cost of carbon (a type of internal carbon price) in their decision making (Woellert & Colman 2021; The White House 2021f). A lack of a consistent approach on carbon pricing could make it difficult to set up CBAMs that operate in a consistent way between the two jurisdictions (Greber & van Leeuwen 2021).

Notwithstanding the uncertainty around whether and how CBAMs will be applied, broader international momentum appears to be gathering behind the use of the mechanism in some form. The United Kingdom is reportedly considering using its G7 presidency to raise the issue of carbon border adjustments (Shankleman 2021). Canada has launched a consultation process with Canadians and key trading partners, to further advance the global CBAM dialogue (Government of Canada 2021b). G7 countries represent almost half of global GDP and include a number of Australia's major trading partners: the United States, the United Kingdom and Japan.

CBAMs and international trade rules

Questions have been raised about the legality of CBAMs under international trade rules, including whether they constitute a form of trade protectionism (Brandt 2017). It is generally accepted that CBAMs do not inherently fall foul of international trade rules, provided they are carefully designed to adhere to the rules of the WTO (Sakai & Barrett 2016; Rocchi et al. 2018). Nonetheless, concerns remain around whether such a mechanism could function as a veil for protectionism.

The WTO is the institutional umbrella of six categories of trade agreements, including the agreement on the trade of goods (GATT), the agreement on trade in services and the agreement on trade-related aspects of intellectual property rights. These agreements set out key trade principles, including a prohibition on trade measures that would discriminate between different trade partners (the most-favoured-nation obligation), and a prohibition on discrimination against imported goods in favour of domestic goods (the national treatment obligation) (Dröge et al. 2018).

Article III of the GATT requires countries imposing a tariff to regulate ‘like’ products in like ways, regardless of whether they are produced domestically or imported. It is unclear if this rule will allow a country to restrict goods and services from being imported when the end product is not polluting, but the methods used to produce the product are more polluting than the standards imposed by the importing jurisdiction; for example, aluminum made from coal-fired electricity compared to aluminum made using low emissions electricity (Granoff 2016; The Economist Intelligence Unit 2019).

Countries implementing CBAMs will need to ensure they are compatible with WTO non-discrimination rules or fall within the GATT exceptions for environmental protections. For example, both domestic and imported products would need to be taxed equivalently based on their embedded carbon content (Panezi 2019). If the underlying rationale for imposing a CBAM is to reduce carbon leakage and induce greater climate ambition, as opposed to protecting the competitiveness of domestic industries, it is more likely to fall under a GATT exception (The Economist Intelligence Unit 2019).

Measures to limit methane leakage

Methane is a greenhouse gas and the second largest contributor to climate change after CO₂ (EPA n.d.). Sources of methane include leaks from the production of natural gas, and from agriculture (livestock farming). In September 2021, the United States and European Union launched the Global Methane Pledge, a joint initiative to reduce global methane emissions by 30 per cent from 2020 levels by 2030 and move towards using best available inventory methodologies to quantify methane emissions (European Commission 2021b).

The European Union published the EU Methane Strategy (the Strategy) in October 2020. The Strategy outlines how the European Union—in partnership with major fossil fuel importers like China, Japan and South Korea—could promote methane reduction efforts globally, including through international monitoring, reporting and verification of methane emissions for gas (European Commission 2020a). Such actions could have significant implications for large natural gas exporters like Australia.

The Strategy notes that the European Union “can use its position as the largest global importer of fossil fuels and a strong player in the agriculture sector to support similar action from global partners” (European Commission 2020a). The European Union has “leverage to promote energy-related methane emission reductions globally” and “intends to mobilise a coalition of key import countries to coordinate efforts on energy sector methane emissions” (European Commission 2020a).

The European Union will seek to establish an independent international methane emissions observatory to measure and report methane emissions. Part of the observatory’s role would be to publish a methane-supply index that would allow buyers to make informed choices when purchasing fuels and to encourage the uptake of emissions reduction technologies (European Commission 2020a). The Strategy notes that, in the absence of significant commitments from international partners on methane emissions reductions, the European Union will consider proposing legislation on targets, standards or other incentives to reduce methane emissions from energy from fossil fuels consumed and imported in the European Union.

The European Union’s efforts to catalyse action on methane emissions build on actions being taken elsewhere. In 2019, the IEA launched a methane tracker noting that a lack of reliable data on methane emissions from oil, natural gas, coal and bioenergy was hampering efforts to reduce them (IEA 2021e). The IEA has also recently released a regulatory roadmap for driving down methane leaks from the oil and gas industry, which provides a step-by-step guide for developing or updating regulation on methane (IEA 2021f).

Supply chain disclosure

Large multinational companies rely heavily on trade within a complex network of goods and services suppliers from around the world. Emissions associated with goods and services in companies’ supply chains (scope 3 upstream and downstream emissions) often outstrip the direct emissions from companies’ own operations (scope 1) and from their electricity use (scope 2).

According to one estimate, upstream supply chain emissions are on average 11.4 times higher than operational emissions (CDP 2021). Similarly, companies which have set emissions reduction targets aligned with climate science through the Science Based Targets initiative (SBTi) report that 80 per cent or more of their overall emissions are scope 3. Box 2.1 discusses the example of the supply chain emissions of automotive manufacturers.

Box 2.1: Decarbonising supply chains in the automotive industry

While most lifecycle vehicle emissions (around three-quarters) come from a car's operation, a significant share (18 per cent) comes from the supply chain (Hetzner 2019). The share of vehicle lifecycle emissions that come from automotive supply chains is likely to rise as sales of battery powered vehicles displace internal combustion engine vehicles.

Decarbonising supply chains is a complex task. Cars contain materials sourced from all around the world: steel, aluminium, copper, plastics, glass, rubber and fibres. For example, a Japanese car maker may utilise steel that was produced in China using iron ore from the Pilbara and metallurgical coal from central Queensland. That steel may have been shipped from China to other countries to be manufactured into parts, before ending up at the manufacturer's assembly plant in Japan.

With the average vehicle containing around 30,000 parts that are made out of a range of raw materials (Blume Global n.d.), the emissions associated with the car sold to the consumer are likely to far outweigh the emissions directly produced by the Japanese car manufacturer itself.

Against this backdrop, companies such as Toyota, Volkswagen and Ford have set targets to be climate neutral across their supply chains (i.e. both upstream and downstream emissions). For example, through its Partnership for A Cleaner Environment program, Ford shares best practices for reducing greenhouse gas emissions with 50 strategic suppliers, and encourages its tier 1 suppliers to cascade this information through their own supply chains (Ford 2020). Ford also uses CDP's climate change questionnaire (Box 2.2) to understand its suppliers' greenhouse gas emissions (Ford 2020).

Many companies are taking on the complex challenge of determining and disclosing their supply chain emissions to meet the increasing demands of consumers and shareholders, and to help them identify potential future risks and vulnerabilities in their supply chains. By the end of 2020, over 1,000 companies, including many of the world's largest, have set or committed to science based emissions reduction targets that include scope 3 emissions (CDP 2021). There are several reporting initiatives that are providing frameworks for business to disclose supply chain emissions (Box 2.2).

Nestle is an example of a company that is actively working with its upstream suppliers to reduce emissions. Actions include investing in nature-based climate solutions and helping farmers to switch to more sustainable farming practices, through accelerating research and development and piloting net zero farms (Nestle 2020). Microsoft is encouraging teams across the company to focus on supply chain emissions, meaning emissions of their suppliers and from customer use of Microsoft products, by extending its internal carbon price to include scope 3 (as well as scope 1 and 2) emissions (Smith 2021). While corporations attempt to work with suppliers in some instances, there is competition among suppliers themselves to reduce their emissions in order to retain their market share supplying large companies.

Beyond reputational motivations, companies are also acting to manage the physical and transitional climate risks to their supply chains, including potential changes to climate policy and regulations in countries where suppliers are located. Supply chain disclosure is increasingly being used by companies to help manage and report on climate-related risk (CDP 2021). In the future, this could help verify the embedded carbon in the production of goods being exported to countries with CBAMs in place, and assist investors seeking to invest in products that are aligned with the sustainable finance standards and taxonomies described in Part 1.

Box 2.2: Supply chain reporting initiatives

CDP (formerly the Climate Disclosure Project) is a non-profit organisation that runs a global environmental disclosure system that includes disclosure on emissions.

The CDP Supply Chain program, which represents over 200 member organisations with US\$5.5 trillion in annual procurement spend, requests information from members' suppliers through questionnaires on environmental issues, including climate change (CDP 2021). Questionnaires are aligned with the recommendations of the TCFD. Lead members include Barclays, L'Oréal, Microsoft and Walmart.

In 2020, CDP sent requests to over 15,000 suppliers and received responses from just over 8,000 (CDP 2021). The CDP reported that 619 Mt CO₂-e were saved in aggregate through supplier activities in 2019–20. The CDP also found that 37 per cent of suppliers were actively driving upstream change in their own supply chains.

The **Global Reporting Initiative (GRI)** is an independent organisation that publishes global standards on sustainability reporting. The GRI reporting standards include a Scope 3 (Value Chain) Standard that corporations can use to help guide them.

The CDP and GRI have worked together over the years to ensure that the two systems are compatible (Rooke et al. 2017). The GRI states that, by using both reporting frameworks in conjunction, corporations can take advantage of the synergies of the two initiatives to improve their reporting and disclosure.

Emissions certification schemes

Emissions certification schemes will play an important role in decarbonising the global economy. It is difficult or impossible to determine the embedded emissions of many products by analysing their final form. As a result, buyers may not have sufficient information to procure low emissions products and sellers of low emissions goods may not be able to obtain corresponding price premiums (White et al. 2021). In short, information asymmetries create the potential for a market failure.

Emissions certification schemes provide a way of correcting for this market failure and therefore facilitating trade in low emissions products. Broadly speaking, emissions certification schemes provide a standardised process for measuring and tracking the emissions associated with particular products along supply chains (COAG Energy Council 2019a). Certification schemes allow consumers and manufacturers to compare similar final products or items in their supply chains and make informed purchasing decisions. Certification is often one of the end-goals in supply chain disclosure.

Guarantee of Origin schemes, which provide information to customers on the source and quality of a product, typically serve as a type of emissions certification scheme that focuses on emissions associated with feedstock and production rather than emissions across others parts of the supply chain (White et al. 2021).

The standards underpinning certification schemes can be developed by industry, national bodies or international bodies. Standards are often voluntary, but regulations and legislation can refer to standards and make them mandatory (Velazquez et al. 2020).

Emissions certification schemes in practice

Emissions certification schemes exist for a variety of industries. A number of certification schemes are under development or active globally for low emissions hydrogen (i.e. clean hydrogen). Over 20 countries plus the European Union are currently cooperating on standards to underpin hydrogen certification through the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) (Box 2.3).

Aluminium is another product for which emissions certification has emerged. The Aluminium Stewardship Initiative (ASI)—a standards-setting and certification organisation whose members include organisations in the aluminium value chain—has developed an independent third party certification program to ensure sustainability is embedded in aluminium production, which includes emissions thresholds which aluminium smelters must meet to receive accreditation (ASI 2020).

In March 2020, the Aluminium Stewardship Initiative released a proposed revamp of its accreditation criteria, including significant changes to provisions for greenhouse gases (ASI 2021a). Under the proposed changes, aluminium smelters would be required to establish a greenhouse gas emissions reduction plan consistent with a below 1.5°C warming scenario to receive certification, including setting interim targets extending no longer than five years (ASI 2021). The draft revision would also require that smelters seeking accreditation to take into account the scope 3 emissions arising from their value chain, rather than simply focusing on their scope 1 and 2 emissions.

ResponsibleSteel—a multi-stakeholder standards and certification initiative—has included a commitment to the Paris Agreement and measurement of site-level emissions as a core principle in its responsible steel standard (Responsible Steel 2019). There are several certification schemes in Europe for biofuels that include requirements for emissions (Stattman 2018). In Australia, Climate Active is a voluntary net zero emissions certification that is available for buildings, events, organisations, precincts, products and services (DISER 2021b).

Box 2.3: Hydrogen certification schemes

Architects of hydrogen certification schemes will need to grapple with a number of design issues (Velazquez 2020):

- which parts of the supply chain certification schemes should cover
- how the accuracy of emissions is balanced against the costs of reporting
- determining the appropriate emissions intensity threshold.

Countries will also need to consider the interoperability of their schemes. If countries do not recognise each other's standards due to differences between schemes, then hydrogen trade could be hampered (White et al. 2021).

Several certification schemes for renewables based or low carbon hydrogen are already in development, the most advanced of which is the European scheme CertifHy. CertifHy is an industry-led Guarantee of Origin scheme focused on emissions from feedstock and production. The Netherlands has expressed its intentions to use CertifHy rather than develop its own standards, while France's certification system is being coordinated with CertifHy (White et al. 2021).

The European Commission intends to develop a certification system for renewable and low carbon hydrogen as part of the European Union hydrogen strategy, taking into account the CertifHy standard (European Commission 2020b). In Australia, the Smart Energy Council is developing an industry-led certification scheme for renewable hydrogen and hydrogen derivatives, based on Europe's CertifHy scheme (Vorrath 2020).

(continued next page)

Australia enjoys a mix of all the key ingredients needed to be a major global player in a thriving clean hydrogen industry. Under Australia's National Hydrogen Strategy—released in 2019—Australia is aiming to become a major hydrogen producer and exporter by 2030.

Australia's National Hydrogen Strategy notes that Australia should seek to play a leading role in the design and development of an international hydrogen guarantee of origin scheme, and that the scheme should initially verify and track emissions associated with production (COAG Energy Council 2019b). The Australian Government released a Hydrogen Guarantee of Origin discussion paper for consultation in June 2021, which aligns closely with the work of the International Partnership for Hydrogen and Fuel Cells in the Economy and extends on the approach of CertifHy. The discussion paper seeks industry input to help inform the design of the scheme (DISER 2021e).

Countries are also cooperating on hydrogen certification through the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), whose members include 21 member countries plus the European Commission. Australia is a member country and has taken a leading role in the Hydrogen Production Analysis Taskforce. The IPHE's Hydrogen Production Analysis Taskforce is "taking initial steps to develop a mutually agreed upon methodology for determining the CO₂ equivalent and other pollutants emissions [sic] associated with the production of hydrogen" (IPHE 2020). The IPHE has released a working paper outlining an initial methodology. This methodology is likely to inform the basis of an international standard to measure and track emissions associated with hydrogen production. The IPHE is the most advanced international forum for discussions on hydrogen certification and has broad representation, including many of Australia's energy trading partners. Establishing standardised methodology will help facilitate market valuation and enable international trade in clean hydrogen.

Implications for trade competitiveness

The design of emissions certification schemes has the potential to affect countries' relative competitiveness in supplying low carbon products. For example, a certification scheme that includes emissions from transport would favour producers who are close to their customers over those who are not (White et al. 2021). Similarly, if emissions intensity thresholds are included in a certification scheme, the level at which they are set will determine which producers are considered suppliers of low emissions products. Certification schemes could also become barriers to trade if importing and exporting countries cannot agree on their design (ANU Energy Change Institute 2020).

The future design of emissions certification schemes may be informed by sustainable finance taxonomies (Section 1.2). For example, the European Union's Hydrogen Strategy notes that the European Commission will develop a certification system for renewable and low carbon hydrogen that is consistent with the European Union Taxonomy (Box 1.5) (European Commission 2020b). As such, the definitions of what constitutes low emissions hydrogen in the European Union Taxonomy could play a key role in determining what kind of hydrogen is both produced and imported in Europe. Likewise, if CBAMs are implemented at the sectoral level, emissions certification schemes could be vital in determining which countries are subject to carbon border adjustments on their exports (as described above).

Countries that shape the design of emissions certification schemes will likely stand to benefit, while countries that do not risk having the rules of others imposed on them (Downie 2021). For Australia, influencing the way the global rules of low carbon trade are shaped and defined will be critical to maximising the opportunities of the energy transition. Through international engagement, Australia can also advocate for certification schemes that ascribe emissions in a way that best promotes global decarbonisation objectives. Australia is well situated to influence such schemes, having already developed a depth of knowledge and expertise in emissions reporting and carbon markets through established institutions and world-leading architecture, including the National Greenhouse Energy and Reporting Scheme and Clean Energy Regulator. As discussed above, Australia has started capitalising on this opportunity through the development of emissions accounting methodologies for hydrogen and hydrogen-based low emissions products through the IPHE.

Carbon clubs

As the world progresses towards net zero emissions, a longer term possibility is the emergence of carbon clubs. A carbon club is a group of countries committed to an agreed level of climate policy ambition that levy import tariffs against all products imported from countries outside the group (Mehling et al. 2017). Unlike in the case of CBAMs, carbon clubs levy tariffs on imports from non-club members regardless of the carbon content of these imports.

Carbon clubs aim to overcome barriers to cooperation on climate change by both penalising countries which do not take action and by creating incentives to join the coalition (in the form of avoiding import tariffs) (Mehling et al. 2017). As the membership of a carbon club grows, the economic incentives for countries to join the coalition also increase (Nordhaus 2015).

Another possibility is that groups of countries collectively agree to rules for products traded between them, from which countries outside the group are excluded. Countries in these ‘carbon bubbles’ could cooperate on issues from regional carbon markets to accounting practices for scope 1, 2 and 3 emissions. For Australia, participating in the same clubs as its major trading partners would be critical to managing the risks and seizing the opportunities of a decarbonising world.

There are significant political, economic and legal challenges associated with the formation of carbon clubs. Which countries might take the lead in forming a carbon club, if any, remains to be seen. One scenario being discussed is the formation of a carbon club led by the European Union and the United States, although significant barriers to such cooperation remain (Greber & van Leeuwen 2021). Other scenarios have been raised, including the formation of a carbon club by middle-sized economies with ambitious targets like the United Kingdom, Scandinavia and Canada (Jaccard 2020). The position that major developing economies like China and India take in relation to any future carbon club would be critical to its success.

Linking the multilateral trade and climate regimes

The international trade regime, which functions under the auspices of the WTO, operates alongside the United Nations Framework Convention on Climate Change (UNFCCC), which is the international framework treaty under which the Paris Agreement operates. The UNFCCC states that “measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade” (UN 1992).

In the lead-up to the 21st Conference of the Parties—at which 197 countries adopted the Paris Agreement (United Nations 2015)—the notion of using trade policy to achieve climate objectives was highly contentious (Teehankee et al. 2012; van Asselt 2014; Dröge et al. 2018). Many developing countries opposed the use of unilateral trade measures on any grounds, including for the enforcement of climate change mitigation measures. No agreement was ultimately reached on how trade and climate policies should interact and as a result, the Paris Agreement does not explicitly reference trade (Dröge et al. 2018).

Efforts are underway in the WTO to consider how international trade and climate policies interact and the extent to which they can be mutually supportive, but progress has been slow (WTO n.d.a). The WTO Committee on Trade and Environment is currently overseeing plurilateral negotiations—which commenced in 2014 between 18 participants representing 46 WTO member—to establish an Environmental Goods Agreement. If realised, an Environmental Goods Agreement would reduce tariffs on goods that are linked to the achievement of environmental and climate protection goals, such as renewable energy generation (WTO n.d.b). In response to the European Parliament's in principle endorsement of a CBAM in March 2021, Australia's Federal Trade Minister announced a plan to eliminate tariffs on wind turbines, solar panels and other green industries. He also confirmed that the Australian Government would be willing to push for this plan as an alternative to the introduction of a European Union CBAM through formal WTO processes (Galloway & Harris 2021).

WTO dispute settlement processes and procedures have long been the main avenue to resolving trade disputes related to climate policy (Flannery 2016). However, the WTO's capacity to regulate and adjudicate multilateral action to reduce global emissions is uncertain. Many countries have expressed concern over the WTO's ability to manage climate-related trade disputes, especially in light of the WTO's diminishing dominance due to the proliferation of regional free trade agreements (FTAs), international investor agreements (IIAs) and more recently, mega-regional agreements (Teehankee et al. 2012; Dröge et al. 2018).

Although the WTO still has significant influence over global trade relations, the role of FTAs and IIAs—agreements between two or more countries designed to eliminate certain barriers to trade and investment and promote stronger trade—continues to grow. At the time of writing, over 300 regional FTAs and 2800 IIAs were in force globally (WTO 2021; UNCTAD 2021).

Promoting solutions to climate change through trade and investment agreements

To date climate change has rarely featured in FTAs or IIAs. For example, the Comprehensive and Progressive Trans-Pacific Partnership (CPTPP)—which is now the largest multilateral FTA in the world in GDP terms—does not explicitly reference climate change or emissions reduction goals (CPTPP 2018). The new United States-Mexico-Canada Agreement (USMCA, which replaces NAFTA) has embedded stronger environmental protections but similarly fails to directly address climate change (Maxwell & West 2019).

However, countries are beginning to turn their minds to the rules of the international climate regime when negotiating new regional FTAs. The Australia-UK FTA will—according to the in-principle agreement—incorporate a provision affirming commitments by each country to address climate change (including under the Paris Agreement), and acknowledging that global trade and investment will play a role in achieving those commitments (DFAT 2021).

Express commitment to the Paris Agreement is integral to the European Union's trade deals with both Japan and Canada. The European Union-Singapore FTA commits both parties to cooperation on trade-related aspects of the current and future international climate change regime, including ways to address the adverse effects of trade on climate (European Commission & Singapore Government 2013). New Zealand has initiated a set of multiparty trade rules with Costa Rica, Fiji, Iceland and Norway that incorporate climate-related concerns through tariff eliminations on environmental goods, commitments on environmental services and new guidelines for voluntary eco-labelling (NZ Foreign Affairs and Trade n.d.).

The Organisation for Economic Co-operation and Development (OECD) has observed that governments are increasingly relying on non-tariff measures, including technical regulations, standards and 'conformity assessment procedures' to indirectly promote climate-related policy objectives in the context of multilateral trade rules. This approach has been taken in several significant, recently concluded regional FTAs, including the European Union-Canada Comprehensive Economic Trade Agreement, the CPTPP and the USMCA (Bellman & van der Ven 2020). The OCED also notes that while governments are recognising the need for investment-related articles in treaties to be coherent with international environmental obligations, countries "appear to have less experience" in this area (Yanguas et al. 2020).

Part 3: Challenges and opportunities for Australia

Key findings

As the world decarbonises, Australian markets will be part of a shifting global trade and investment landscape. Several of Australia's key exports have high emissions associated with their production and some, particularly coal and gas, also have high emissions associated with their use in the countries that import them. Understanding the emissions along our export value chains, within Australia and overseas, will be critical to assessing emerging risks.

Australia can continue to prosper in a decarbonising world by producing the cleanest, highest quality exports at the lowest cost. Whereas competition in global markets has historically rested on the relative costs of production, quality, proximity to markets and security of supply, competitive advantage will increasingly rest with those also producing products with the lowest carbon content. In a decarbonising world, it makes sense to be 'carbon competitive'.

The shift to a net zero world will present other economic opportunities for Australia. Australia is endowed with clean energy and abundant reserves of raw materials required for low emissions technologies—critical minerals like lithium and cobalt and other minerals like copper and nickel. Sophisticated financial services sectors and carbon markets position Australia to capitalise on opportunities in climate finance and environmental services.

In a Paris Plus environment, governments will play a key role in enabling markets to function effectively. They can do this by ensuring the necessary information is available on climate change and emissions; encouraging the development of open, competitive and transparent markets; implementing rules and regulations to create trust in markets and guard against market failures; guiding and facilitating investment through appropriate long term planning; investing in areas where markets are not doing enough; and engaging deeply in international rule making.

As a low cost producer in the fastest growing region in the world, Australia has historically enjoyed competitive advantages as an exporter. The rapidly evolving global trade and investment policy environment presents new challenges and opportunities for Australia, shifting the basis on which it has historically competed and opening up new markets. Part 3 of this report discusses this new 'Paris Plus' policy architecture, how it impacts different parts of Australia's export value chains, and how Australia can take advantage of new and emerging opportunities.

3.1 The world of Paris Plus

Reducing emissions to achieve the temperature goals of the Paris Agreement is a complex, global challenge. At the core of the Paris Agreement is the concept of a Nationally Determined Contribution (NDC)—a country Party's formal statement of its emissions reduction target and intended climate actions in relation to abatement, adaptation and resilience and climate finance. Emissions reductions, targets and actions are applied to the emissions generated within a country's geographical borders. This is the focus of internationally agreed greenhouse gas accounting standards. NDCs are developed by each country unilaterally, with the Paris Agreement goals in mind.

Parts 1 and 2 above reveal trends that indicate a new 'Paris Plus' architecture has emerged and is rapidly evolving. Trade and investment are the ties that bind private enterprise, governments and nations together in the decarbonisation journey. As the task of tackling climate change takes on greater urgency, governments and multinational corporations are enhancing their approaches to managing climate risk, and considering emissions generated not just within their own borders or operations, but emissions generated across all the parts of the global supply chains of which they are a part. This new Paris Plus architecture comprises the various agreements, cross-border policy instruments and actions that build on the foundations of the Paris Agreement with the purpose of further contributing to its goals. Elements of 'Paris Plus' include, but are not limited to:

- the development of policies such as CBAMs, and the idea of CBAM clubs, which aim to ensure that strong domestic action to reduce emissions does not unfairly disadvantage local industries competing against foreign imports and to encourage other countries to take commensurate climate action
- new regional carbon trading initiatives, such as the Australian Government's announced high integrity carbon offset scheme for the Indo-Pacific region, intended to boost public and private investment in climate action and help countries meet their international climate change commitments
- voluntary adoption by companies of climate related financial disclosure, with growing momentum around countries implementing mandatory reporting and financial regulators undertaking climate risk 'stress testing' of financial institutions
- global funds managers and multinational corporations voluntarily adopting net zero emissions targets for their investment portfolios and limiting new investment in emissions intensive activities
- courts, in reviewing environmental approval decisions and assessing the content of directors' fiduciary duties (among other things), requiring governments, regulators and corporations to consider the climate change implications of their decisions.

Actions taken by governments and the private sector towards the goal of net zero emissions are complementary. Climate-related financial disclosure is a good example. The development of the TCFD framework has been a privately led initiative, but governments have a fundamental role in providing information on climate scenarios, which companies need to manage their risks, inform their investors and guide their decisions. Financial regulators are providing further guidance on climate risk reporting, which is helping to level the playing field by raising awareness of reporting obligations and encouraging consistent and regular reporting. International carbon trading is another example, with governments establishing frameworks and rules for carbon markets that allow the private sector to trade with confidence in high integrity carbon offsets.

Ultimately, only markets can mobilise and allocate the massive amounts of capital to make the investments required for transition to a resilient, net zero economy. The Climate Change Authority has identified six key enablers Governments can pursue in support of the drive to net zero emissions (CCA 2021):

Information	Ensuring the necessary information is available for decision making. Efficient collection of accurate, consistent and comprehensive information on emissions and decarbonisation will minimise costs on business, while informing consumer choices and supporting optimal business and government decision making.
Markets	Encouraging the development of open, competitive and transparent markets to drive lowest cost decarbonisation outcomes. Many abatement technologies are viable today and ready to be deployed to market, subject to investor and consumer choices.
Rules	Implementing rules and regulations to create trust in markets and guard against market failures, and ensuring that they are up-to-date and not impeding new ways of doing things that eliminate emissions.

Planning	Guiding and facilitating investment through appropriate long term planning. Urban, infrastructure, workforce and land use planning can support timely and efficient mitigation, sequestration and adaptation. Governments can also assist workers and communities to make decisions about the future by planning and communicating their intent in advance.
Investment	Public investment in areas where markets are failing to make the necessary investments; in science, research, development and deployment of abatement technologies and in infrastructure. Governments can stimulate innovation and provide high risk capital for new technologies, shift activities down the cost curve to price parity and catalyse new markets.
International engagement	Through diplomatic and trade channels, governments can maintain and foster international partnerships to decarbonise the global economy and to harmonise international rules that recognise each country's unique circumstances. Partnering on clean technologies and fuels will create new trade opportunities and help less developed countries to bypass the emissions intensive development of industrialised nations.

3.2 Value chain emissions

Under international greenhouse gas accounting rules, countries are not responsible for emissions that occur from the use of their exports overseas. As a result, governments have traditionally focused on emissions that occur within their borders, without regard for overseas emissions in the value chains of their exports.

However, both markets and governments are becoming increasingly interested in emissions across the entire value chain. Investors and consumers are increasingly focusing on emissions from production, transport and consumption, regardless of where in the world the emissions occur. Governments are exploring trade measures, such as CBAMs and measures to limit methane leakage (described in Part 2 Section 2.1) as a way of managing carbon leakage, protecting their trade exposed industries and encouraging global emissions reduction.

Consequently, Australia's exports with high upstream emissions in their value chain ('embedded emissions') and those with high downstream emissions (emissions that occur when they are used overseas, such as from the combustion of fossil fuels) are exposed to a risk of declining demand as countries and companies decarbonise.

Many of Australia's major exports are emissions intensive in the production phase, such as coal, oil and gas, beef and aluminium (and aluminium ores and concentrates). Some exports—coal, oil and gas—are also emissions intensive after exportation, when they are transported and combusted. Table 3.2 shows Australia's major exports in 2019–20.

Table 3.2: Australia's top 20 exports, 2019–20

#	Export	A\$ billion	% share of total
1)	Iron ore	103	21.6
2)	Coal	55	11.5
	— <i>Metallurgical</i>	34	7.2
	— <i>Thermal</i>	20	4.3
3)	Natural gas	48	10.0
4)	International education	40	8.3
5)	Gold	24	5.1
6)	Personal travel services	16	3.4
7)	Beef, f.c.f	11	2.4
8)	Aluminium, alumina & bauxite	9	1.9
9)	Crude petroleum	9	1.8
10)	Copper ores & concentrates	7	1.4
11)	Professional services	6	1.3
12)	Telecom, computer & information services	6	1.2
13)	Financial services	6	1.2
14)	Meat (excl beef), f.c.f.	6	1.2
15)	Technical & other business services	5	1.1
16)	Wheat	4	0.8
17)	Aluminium	4	0.8
18)	Lead, zinc & manganese ores & concentrates*	4	0.8
19)	Pharm products (excl medicaments)	4	0.8
20)	Copper	3	0.7
	<i>Other</i>	108	22.6
	Total	475	100

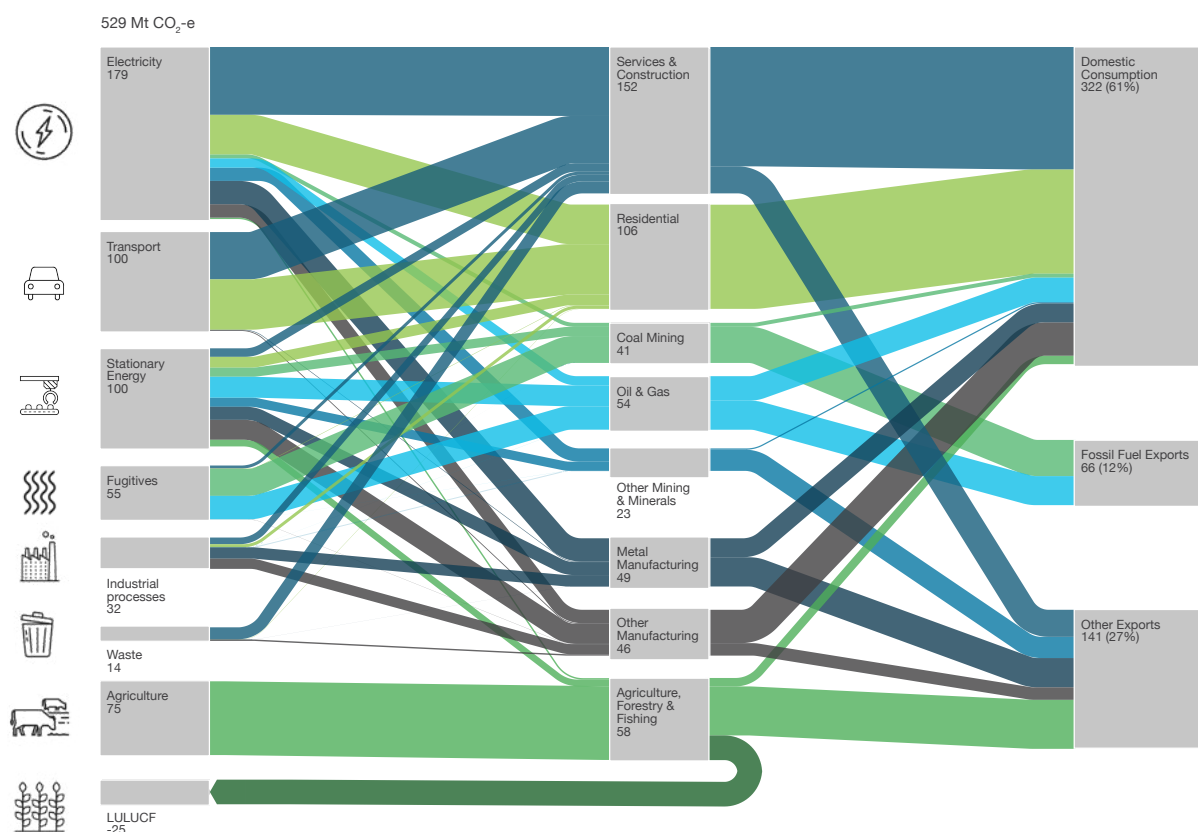
Source: DFAT 2020b; DISER 2020c.

Notes: *Includes some other ores and concentrates; f.c.f stands for fresh, chilled, frozen.

Almost 40 percent of the emissions reported in Australia's national greenhouse gas inventory are associated with production of exports (Figure 3.1). These production emissions are 'embedded emissions'. Embedded emissions include emissions associated with the transport of goods (Melton 2018; Carbon Leadership Forum 2020) but do not include emissions from the direct use of a good, such as emissions from the combustion of coal. Figure 3.2 shows the embedded production emissions of Australian exports worth over A\$3 billion.

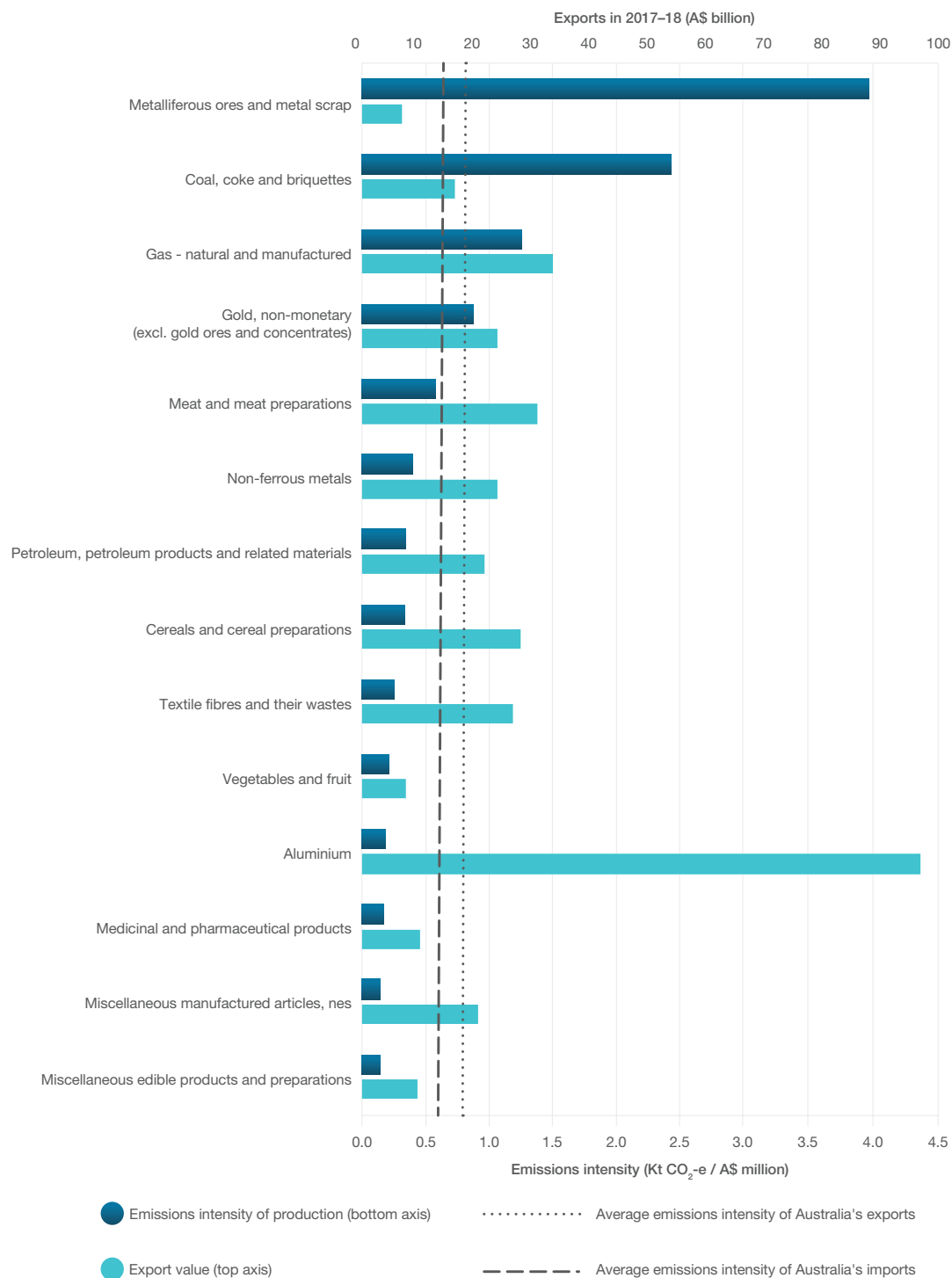
While Australia's domestic emissions comprise less than 1.3 per cent of global emissions, approximately three times as much carbon is emitted when Australia's coal and gas exports are used by customers overseas. A 2019 study concluded that assigning the overseas emissions associated with Australia's fossil fuel exports to Australia would have lifted Australia's share of global emissions from 1.4 per cent in 2017 to around five per cent (Parra et al. 2019). The study also suggested that, by 2030, emissions from the use of Australian fossil fuel exports alone could be responsible for over 10 per cent of global emissions.

Figure 3.1: Australia's emissions—inventory and economic sectors, and end-use



Source: DISER 2021c (2018-19 data).

Figure 3.2: Implied emissions factors for major Australian exports



Source: DEE 2019.

Notes: Only exports worth more than A\$3 billion in 2017–18 are shown. Average emissions intensity for Australia's exports/imports is a volume weighted average. Export categories differ from Table 3.1 due to emissions intensity data not being available at a sufficiently detailed level.

3.3 Paris Plus and competitiveness

The competitive landscape in which Australia operates is shifting in two key ways as the result of global decarbonisation efforts and the emergence of a Paris Plus policy architecture.

First, as the world transition towards net zero emissions, carbon will increasingly become a factor affecting the competitiveness of countries, industries and businesses. Those who can supply goods with relatively lower carbon content will increasingly be advantaged as the world decarbonises. We term this new competitive dynamic ‘carbon competitiveness’.

The second key dynamic is that demand for some goods and services will increase as the world shifts towards net zero, while demand for others will decline. For example, on a decarbonisation trajectory consistent with holding global warming to 2°C, lithium demand would increase 16-fold by 2040 driven by the uptake of electric vehicles (EV) (IEA 2021g). In contrast, demand for coal—both thermal and metallurgical—would fall from 154 EJ to 17 EJ by 2050 if the world reaches net zero emissions by 2050 and limits warming to 1.5°C (IEA 2021d). Australia is exposed to these shifts in global trade patterns.

As such, there are two ways in which Australia can thrive in the world of Paris Plus:

- producing clean exports, with low embedded emissions, at low cost, such as low or zero emission industrial commodities or agricultural goods
- seizing other export opportunities associated with growing demand for certain goods and services, such as low emissions technologies, clean technology minerals and finance and carbon market services.

Table 3.2 summarises the opportunities for Australia. The next two sections of this report consider whether Australia is well positioned to seize them. Section 3.4 looks at Australia’s carbon competitiveness, while Section 3.5 looks at Australia’s potential to capture the other export opportunities identified in Table 3.3.

Table 3.3: Market opportunities for Australia

Opportunity	Example	Description
Carbon competitiveness	Low or zero emission industrial commodities	Industrial commodities such as green steel and green aluminium that are made using a low or zero emissions process (Case study 3.3).
	Low emission agricultural products	Low emissions agricultural products such as beef (Case study 3.1 and 3.2) and grains.
	Renewable electricity	Electricity generated by wind, solar and other renewables transmitted across country borders via cables (Case study 3.4).
	Low emissions fuels	Fuels produced using renewable energy (for example, green hydrogen) or fossil fuels with carbon capture and storage (for example, blue hydrogen).
Low emissions technologies	Emissions reductions technologies	Technologies that help reduce emissions, such as energy efficiency technologies, renewable energy and energy storage technologies, CCS, livestock feeds and supplements (Case study 3.1 and 3.2), and electric vehicle components.
	Emissions measurement technologies	Technologies that measure or monitor emissions, such as technologies for measuring soil carbon or fugitive emissions from natural gas.
Minerals for low emissions technology	Critical minerals	Minerals that are essential for low emissions technologies but that face potential supply shortages, such as lithium and neodymium.
	Other minerals	Other minerals that are essential to low emissions technologies, such as uranium, nickel and copper.
Finance, information and carbon market services	Green financial products	Green bonds and loans, benchmarked investment funds, and certification services.
	Carbon market services and land-based offsets	High integrity carbon offset generation and trading through markets facilitated by a range of service providers and landholders.
	Information services	Climate information services and technical support, provided to industry to improve climate-related decision making and reporting (Case study 3.5).

3.4 Australia's carbon competitiveness

The following sections provide an overview of Australia's 'carbon competitiveness' in relation to some of our major exports (LNG, beef, alumina, aluminium and steel) and two prospective exports (low carbon hydrogen and electricity). These are markets in which Australia can gain a competitive edge by producing clean exports, with low embedded emissions, at low cost.

LNG

Australia rivals Qatar as the world's largest LNG exporter (DISER 2020c). Gas demand is expected to decline on a Paris-aligned decarbonisation trajectory over the 30 years to 2050 (IEA 2020c, BloombergNEF 2020; IEA 2021a). A growing number of LNG importers are looking to purchase 'carbon neutral' LNG—LNG where emissions from production, transport and/or consumption of the gas have been offset—although this market remains very small (Blanton & Mosis 2021; Thompson, G. 2020). There have been several shipments of carbon-neutral LNG from Australia in recent years, including from Queensland LNG and Ichthys LNG.

There is limited public information on the embedded emissions of different countries' LNG exports. However, the available data suggest that Australian LNG is, on average, around the middle of the pack globally (Woodside Energy 2019; Wood Mackenzie 2021; Kennedy 2021). According to oil and gas consultancy Wood Mackenzie, over half of Australian LNG plants have an emissions intensity of production above the global average (Wood Mackenzie 2021). Australia's east coast LNG projects, which are based on coal seam gas resources, have a significantly lower emissions profile than those to the west (Woodside Energy 2019).

There are a number of options that Australia could look at to reduce the emissions intensity of its LNG exports (CSIRO 2017), including carbon capture, utilisation and storage (CCUS, referred to as CCS when only storage is relevant), and offsetting the residual. CCS is currently being used at the Gorgon LNG facility in Western Australia after a number of start-up issues. Several Australian gas and LNG producers are currently considering CCS projects to accompany the development of new gas fields, including Santos and Woodside (Clark & Tilly 2021; Macdonald-Smith 2021). There have been differing views put forward on the viability of largescale deployment of CCS projects in Australia (Hewett 2021) and ultimately more information on Australia's geosequestration potential is needed.

The Australian Government has included a technology stretch goal for CO₂ compression, hub transport and storage under A\$20 per tonne of CO₂ in its First Low Emissions Technology Statement (DISER 2020d). The Australian Government also recently included a CCS method as part of its Emissions Reduction Fund, and has indicated it will develop a method for CCUS, including in the production of industrial and building materials like insulation or concrete (Taylor 2021a). Santos has since begun registering its A\$210 million Moomba CCS project in South Australia under the CCS method, which will be one of the biggest in the world and has the potential to store 1.7 million tonnes of CO₂ each year, the equivalent of powering about 200,000 homes (Santos 2021).

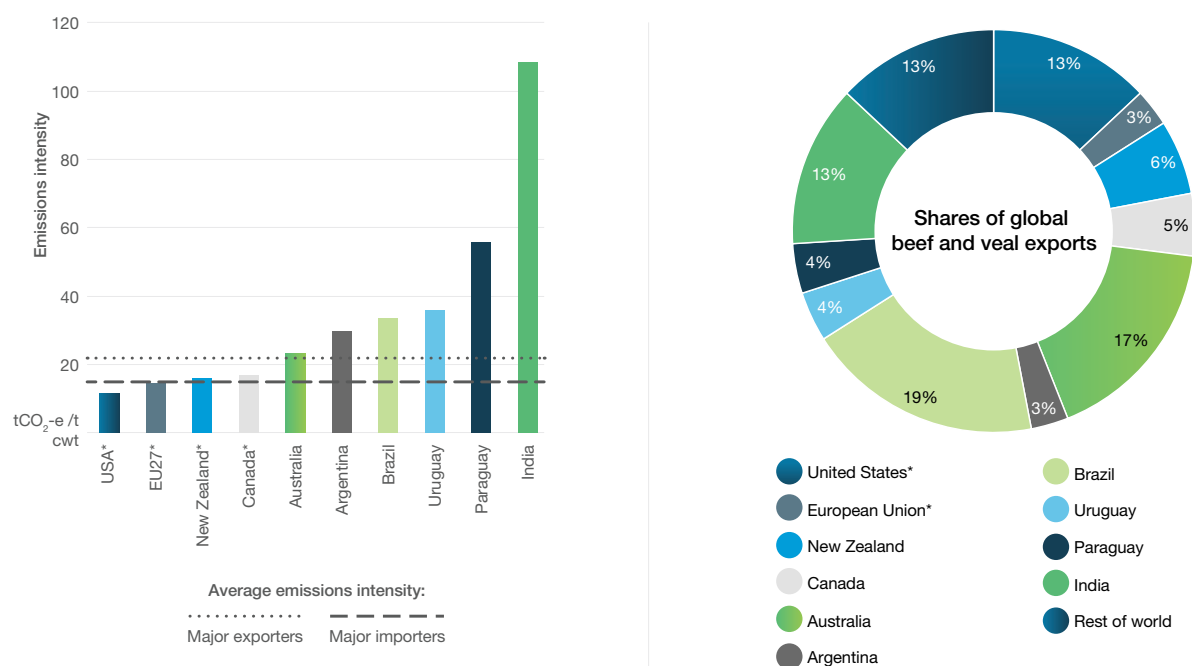
Beef

According to the Australian Bureau of Agricultural and Resource Economics (ABARES), the emissions intensity of production may become a factor affecting Australian agriculture's international competitiveness (Greenville et al 2020). The ABARES report noted that economies like the European Union and United Kingdom could look to implement measures like CBAMs on agricultural imports, and that consumers may increasingly factor a product's emissions into their purchasing decisions.

Beef is Australia's largest agricultural export (Table 3.2). At present, the emissions intensity of Australia's beef production is around the world average for major exporters, but higher than the domestic industry levels of major importing countries (Figure 3.3). In short, over the longer term, there may be potential for Australia to improve its competitive position in beef markets by lowering the emissions intensity of its beef production. This is being recognised by industry, such as through Meat and Livestock Australia's (MLA) aspiration for carbon neutral red meat by 2030 (Case study 3.1)

There are a range of existing and longer term options to improve the emissions intensity of Australia's agricultural production (see Part 1, Section 1.3). For example, livestock emission reduction technologies are being researched and commercialised in Australia, including a feed supplement seaweed called *Asparagopsis*, which reduces the methane emissions that are produced in the digestive fermentation process (Case study 3.2).

Figure 3.3: Emissions per unit of beef produced, 2008–2017



* Country or region is both a major importer and a major exporter

Source: Greenville et al. 2020.

Notes: *Country or region is both a major importer and a major exporter. The chart shows Food and Agriculture Organization of the United Nations estimates of the emissions intensity of top ten exporters and importers of beef in terms of volume. Dashed lines are weighted average across those exporters and importers. Rest of world not presented on left hand chart due to significant variation across the grouping.

Case study 3.1: Meat and Livestock Australia's carbon neutral commitment

MLA, representing Australia's red meat and livestock industry, has set an aspirational target to become carbon neutral by 2030. The target encompasses Australian livestock production, including feeding and meat processing. MLA is investing in research and development across the following areas:

1. avoiding greenhouse gas emitting activities on farms and in feedlots and processing
2. carbon storage on farm via trees, legumes and pastures
3. integrated management systems linking greenhouse gas emissions avoidance and carbon storage activities into farm system thinking
4. leadership building to support growth in capacity and competency among individuals and organisations (MLA 2019).

MLA recognises the importance of carbon neutrality to the Australian red meat industry's social licence to operate, among other things, stating that "staying ahead of current and future consumer, customer and community expectations regarding environmental credentials allows red meat producers to stamp their mark in a competitive global protein market" (MLA n.d.).

Case study 3.2: FutureFeed Pty Ltd

Woolworths, GrainCorp and Harvest Road announced in 2020 that they would become joint venture partners in FutureFeed, a company established by the CSIRO to commercialise Asparagopsis. Asparagopsis is a natural seaweed product that, when fed to cattle and sheep, accelerates their growth while reducing the methane emissions that are produced in the digestive fermentation process. A joint field trial by the CSIRO and the University of California has demonstrated promising results, finding that supplementing 0.25 per cent (low dose) or 0.5 per cent (high dose) of a cow's daily feed with Asparagopsis resulted in a reduction in methane emissions of 45 and 68 per cent respectively over a 147 day period (Roque et al. 2021). The company holds the relevant commercial intellectual property rights to the technology developed by the CSIRO, Meat and Livestock Australia and James Cook University (Future Feed n.d.).

FutureFeed's technology has been heralded as game changing for Australia's beef and dairy industries (Thompson, B. 2020). Direct livestock emissions account for around 70 per cent of the agricultural sector's emissions and 11 per cent of national greenhouse gas emissions, and have historically been regarded as hard to abate (Department of Industries and Regional Development 2021).

According to FutureFeed, if just 10 per cent of livestock producers added 1.0 per cent of Asparagopsis Seaweed Meal to the daily feed intake of ruminant livestock, the emissions reduction impact would be equivalent to taking 100 million cars off the road (FutureFeed n.d.).

Alumina, aluminium and steel

Australia's largest manufacturing export is aluminium (Table 3.2). Aluminium production is extremely emissions intensive (Figure 3.2) because of the large amount of electricity used in the smelting process to extract the metal. Around 85 percent of emissions for aluminium production relate to electricity use (DISER 2020f), with these emissions occurring at power stations. At present, the energy intensity of Australian aluminium production is around the global average (International Aluminium 2021; IEA 2020d). Australia also exports other emissions intensive manufactured goods like steel, which was worth around A\$0.9 billion in 2019–20 (DISER 2021d).

Separate to the emissions associated with aluminium smelting are those associated with alumina, an intermediary product in aluminium production that is refined from ore (bauxite). Australia is the world's largest exporter of alumina, with around 92 percent of emissions from alumina production coming from the direct combustion of fuels such as coal and gas (DISER 2020f). This energy use provides different challenges and opportunities for decarbonisation than the later smelting process. The emissions intensity of alumina can be lowered in the shorter term through by using gas over coal, and in the longer term hydrogen could completely replace fossil fuel use (Case study 3.3).

Australian iron ore producer Fortescue has announced plans to develop a low emissions steel pilot plant in the Pilbara region, close to abundant renewable energy and iron ore resources (Case study 3.3). The Australian Government identified both low emissions aluminium and steel as opportunities for Australia in its First Low Emissions Technology Statement (DISER 2020d).

There are opportunities for Australia to take advantage of its mineral endowments and renewable energy resources to produce and export low emissions energy intensive metal products such as aluminium (bauxite/alumina) and steel (iron ore) (Wood & Dundas 2020). Australian aluminium smelter Tomago has recently announced it is considering transitioning to renewable electricity supply from 2029 (Cox 2021).

Case study 3.3: Manufacturing green steel and aluminium in Australia

Alumina Limited, Australia's largest alumina company, recently announced that it is looking to market a majority of its product as 'EcoSource': a low carbon product launched in September 2020 by Alumina and its partner, Alcoa. While the production system is not changing, the Western Australian refineries have a lower emissions footprint than many of the world's refineries due to the use of gas over coal or oil. The company states that this branding shift is being driven by consumer demands and their willingness to pay premiums for the low emission product.

In the longer term, the company will look at options to blend hydrogen with gas in existing gas pipeline systems, the intention being to enable hydrogen to replace gas completely over time (Ker & Evans 2021).

Fortescue Metals Group is one of the largest iron ore producers in the world. Fortescue created Fortescue Future Industries (FFI) in 2020 to establish a global portfolio of large scale, low cost hydropower, geothermal, solar and wind assets to support hydrogen production. FFI is trialling and demonstrating green hydrogen technologies in global-scale commercial environments, while also rapidly evolving into a green hydrogen and electricity producer of similar scale.

In early 2021, Fortescue Metals Group announced plans to start conducting trials to use renewable energy in the Pilbara to convert iron ore to green iron at low temperatures, without coal, and develop a green steel pilot plant. The Pilbara was chosen for its proximity to iron ore and abundant renewable energy resources, features that place Australia in a "unique position to scale green steel" (Forrest 2021).

Low carbon energy supply

Australia's land, renewable electricity, gas and shipping infrastructure, experience in energy trade, and location could enable it to capture a large share of the emerging global low carbon energy market. Globally significant renewable energy export projects are already being established in the Northern Territory and Western Australia (Case study 3.4).

Becoming a clean energy export hub would enable Australia to achieve the scale needed to be a globally competitive producer of hydrogen and renewable electricity, leading to flow-on benefits for Australia's manufacturers and energy consumers (Wood & Dundas 2020). Some modelling suggests that if Australia produced 200 per cent of its electricity needs by 2050, and exported the surplus as hydrogen or other energy intensive products like green steel or aluminium, electricity costs in the National Electricity Market would be lower than in a baseline scenario (Ueckerdt et al. 2019).

Hydrogen produced using renewable energy has the potential to become a EUR€10 trillion (A\$16 trillion) global industry by 2050 for the utilities sector alone, and could reduce emissions in a number of hard to abate sectors, such as manufacturing and transport (Goldman Sachs 2020). The likely markets for Australian hydrogen include—in order of size of demand—are Japan, South Korea, China and Singapore (ACIL Allen 2018). Fossil fuels paired with CCS provide another process for the production of clean hydrogen.

Through the former Council of Australian Government's Energy Council, the Australian Government together with state and territory governments published Australia's National Hydrogen Strategy in 2020. The strategy sets out a roadmap for developing a global clean hydrogen market (COAG Energy Council 2019b). The Australian Government has also identified clean hydrogen as one of five priority technologies in its first Low Emissions Technology Statement, through which it will leverage private sector support and investment with the aim to achieve production under A\$2 per kilogram (DISER 2020d).

The National Hydrogen Strategy is an example of how governments can seek to maximise the opportunities presented by growing global low emissions energy trade through a targeted policy to reduce barriers to industry development. The strategy encompasses attracting investment and customers; international engagement on hydrogen certification; developing rules and regulations for safety and logistics; overcoming challenges to economic viability associated with high upfront costs; and pursuit of technological breakthroughs to assist achievement of hydrogen production at commercial and economic scale.

Through the National Hydrogen Strategy, the Australian Government launched its A\$464 million 'Activating a Regional Hydrogen Industry: Clean Hydrogen Industrial Hubs' program in September 2021. The aim of the hubs is to promote a variety of sources of local and regional demand for hydrogen while also facilitating hydrogen exports. They are intended to create focal points for co-investment between international and domestic public and private entities.

The Australian Government is working with many international partners to establish and grow co-operation and investment in hydrogen technology, development and exportation.

- In September 2021, Australia, India, Japan and the United States signed a new Clean-Hydrogen Partnership: to strengthen and reduce costs across all elements of the clean hydrogen value chain, leveraging existing bilateral and multilateral hydrogen initiatives in other fora.
- Australia entered into an agreement with Germany to investigate the feasibility of a renewable hydrogen supply chain between the two countries (DISER 2020e). The partnership with Germany was extended in June 2021. The two countries will invest in a series of new initiatives to accelerate the development of a hydrogen industry, creating new economic opportunities and jobs while reducing emissions.
- The Australian and Japanese Governments have signed a joint statement of cooperation with Japan on hydrogen and fuel cells (DISER & Birmingham 2020). This collaboration was extended through a partnership on decarbonisation through technology announced in June 2021, with both countries committing to collaborate and coordinate together on ways to support economic growth and resilience of the Indo-Pacific region and particularly amongst ASEAN members.
- The Australian Government also announced in June 2021 that Australia and Singapore will establish a A\$30 million partnership to accelerate the deployment of low emissions fuels and technologies like clean hydrogen to reduce emissions in maritime and port operations (Taylor 2021b).

Case study 3.4: Renewable energy for Australian export markets

Australia is uniquely positioned to export clean energy to the Asia Pacific. Given its abundant renewable resources (predominantly solar and wind), global investors are looking to Australia as an ideal site for large scale renewable electricity projects with trade potential. Three potentially globally significant renewable energy export project proposals are described below.

The **Australia-Asia PowerLink** (AAPowerLink) is a proposed electricity infrastructure project in the Northern Territory which, if realised, will feature the world's biggest solar PV plant, the world's largest battery and the world's longest subsea high-voltage direct-current (HVDC) cable. Together, these will enable '24/7 transmission' to Darwin, Singapore and ultimately other ASEAN markets. The AAPowerLink is backed by prominent Australian business leaders—Mike Cannon Brooke's Grok Ventures and Andrew Forrest's Squadron Energy—and being developed by Singaporean firm Sun Cable. Having been granted major project status by the Northern Territory Government in 2019 and the Federal Government in 2020, it is expected to begin operating in early 2026 and by 2027 could export up to A\$1 billion of electricity annually while adding A\$8 billion to the Northern Territory's economy (Andrews & Taylor 2020; Sun Cable 2021).

The AAPowerLink project also aligns with Singapore's emissions reduction aspirations. While the Singaporean Government has expressed a net zero aspiration, natural gas continues to account for over 95 per cent of Singapore's fuel mix (EMA 2020). The AAPowerLink could provide up to 20 per cent of Singapore's electricity carbon neutrally, significantly improving the country's electricity emissions profile (Collins 2020).

The **Asian Renewable Energy Hub** (AREH) is another large scale renewable electricity project, located in the Pilbara region in Western Australia. The project proposes to harness the region's comparative advantage in wind and solar resources to generate 26,000 megawatts of renewable electricity.

The project is backed by an international consortium of global energy leaders, including InterContinental Energy, CWP Energy Asia and Vestas. It is also supported by the Department of Foreign Affairs and Trade and partnered with the Australian National University's Energy Change Institute and Pilbara's Nyangumarta People (DFAT 2020c).

The AREH secured major project status from the West Australian Government in 2018 and the Federal Government in 2020 (Taylor & Andrews 2020). AREH's original project proposal involved renewable electricity trade via HVDC cable with Singapore and potentially Indonesia, and this proposal received Federal Government approval in November 2020. However, in response to rapid developments underway in green hydrogen technologies and markets, the hub's focus has shifted to producing ammonia for export, and a new project proposal was submitted (Miolin & Standen 2021). In June 2020, the Federal Government rejected this proposal on environmental grounds (DAWE 2021). The AREH consortium has since reportedly stated they are working closely with the Federal Government to amend plans as necessary to ensure the project goes ahead (Miolin & Standen 2021).

The **Western Green Energy Hub** (WGEH), a major new hydrogen proposal for south-eastern Western Australia, could produce up to 50 gigawatts of renewable energy across 15,000 square kilometres to deliver up to 3.5 million tonnes of renewable hydrogen (or 20 million tonnes of green ammonia) annually, to make it one of the largest energy projects in the world (WGEH 2021; InterContinental Energy 2021). The WGEH project is being developed by the consortium behind the AREH, and Mirning Green Energy, a wholly owned subsidiary of the Mirning Traditional Lands Aboriginal Corporation. The WGEH proposal was welcomed by the WA Government in July 2021, but is yet to go through formal approval processes (MacTiernan 2021).

3.5 Other market opportunities

Low emissions technologies

As well as low embedded emissions products (see Section 3.4), Australia is well positioned to be a supplier of low emissions technologies. For example:

- In the transport sector, Australian-founded company Tritium provides EV fast chargers to the global market with unique solutions to deal with environmental factors such as cold climates (Tritium Charging 2021).
- In the agricultural sector, several promising livestock emissions reduction technologies are being researched and commercialised in Australia for domestic use and export. Examples include: a feed supplement seaweed called *Asparagopsis* (Case study 3.2); an anti-methanogen vaccine called 3-NOP (3-Nitrooxypropanol); and alternative feeds such as the legume *Leucaena*. A number of these technologies also offer potential productivity benefits.
- In the industrial sector, FFI is exploring not only opportunities for green steel pilot projects in Australia (Case study 3.3) but partnering to deploy this technology to overseas customers as part of their own industrial processes such as steelmaking (FMG 2021a). This is part of Fortescue's initiative to reduce the company's scope 3 emissions (FMG 2021b), and has potential to increase demand for Australia's bulk commodity products, where Australia has added value by making them into low embedded carbon products. This includes clean hydrogen, as described in Section 3.4, which can be used as a feedstock for these processes overseas.

At its core, the Government's Technology Investment Roadmap aims to accelerate the development of technologies critical to the long term decarbonisation of the Australian economy by making them economically competitive. Such technologies, like those listed above, are likely to have appeal in international markets.

Minerals for low emissions technologies

Low emissions technologies generally require more minerals than the fossil fuel-based technologies they are increasingly replacing (Kim & Karpinski 2020). For example, an EV uses around five times as many minerals as a conventional internal combustion engine vehicle, and an onshore wind plant requires eight times as many minerals as a gas fired plant producing the same output.

Under the International Energy Agency's (IEA) Sustainable Development Scenario, total mineral demand from clean energy technologies quadruples (IEA 2021g). By 2040, clean energy technologies are a major demand segment in many minerals markets, accounting for 40 per cent of demand for copper and rare earth elements, 60 to 70 per cent for nickel and cobalt and almost 90 per cent for lithium. Similarly, under a World Bank scenario where global warming is limited to 2°C, annual demand in 2050 is expected to be almost 500 per cent greater for lithium, 450 per cent greater for cobalt and 100 per cent greater for nickel, compared to current demand for those minerals (Hund et al. 2020).

Australia has some of the world's largest reserves of critical minerals: titanium, zircon, cobalt, tungsten and lithium (Austrade 2020), as well as non-critical minerals important for low emissions technologies: nickel, copper, bauxite and iron ore. The combined value of Australia's lithium, nickel and copper exports is expected to double from A\$15 billion in 2019–20 to A\$30 billion in 2025–26, partly as a result of strong demand from low emissions technologies (DISER 2021a).

The geopolitics surrounding the minerals needed for the energy transition could favour Australian producers. The global production of many of these minerals is highly concentrated (Kim & Karpinski 2020). Australia, China and the Democratic Republic of the Congo currently control over three-quarters of global output for lithium, cobalt and rare earth metals. China accounts for 50–70 per cent of global lithium and cobalt refining (Kim & Karpinski 2020). Australia's stable and safe investment environment, good road, rail and shipping infrastructure and sophisticated mining industry is a source of competitive advantage (DIIS & Austrade 2019).

The Australian Government has published a Critical Minerals Strategy and a Global Resources Strategy. The former is aimed at promoting investment in, and increasing the competitiveness of, Australia's critical mineral industry and connecting projects with infrastructure development (DISER 2019b). The latter seeks to support Australia's attractiveness and competitiveness for resource investments, including identifying new markets for resource commodities and critical minerals (DISER 2021f). The Government has since established a Critical Minerals Facilitation Office to attract and facilitate investment in Australia's critical mineral industry and this year released a new roadmap covering the sector—the Resources Technology and Critical Minerals Processing National Manufacturing Priority Road Map, which sets goals and actions to capture opportunities in resources technology and critical minerals processing (Andrews, Morrison & Pitt 2021).

Uranium—a fuel used in nuclear power plants—represents another potential opportunity for Australian exporters as the shift towards a net zero world accelerates. Under the IEA's 1.5°C Net Zero by 2050 Scenario, nuclear generation capacity doubles over the next 30 years, and nuclear reaches 11 per cent of the global energy mix, up from 5 per cent in 2019 (Part 1, Figure 1). Most new nuclear capacity under development is located in Asia, with China being a major centre of activity (DISER 2021a).

In 2019–20, Australia's uranium exports were worth around A\$700 million (DISER 2021a). In the short term, uranium exports are expected to decline due to the closure of Energy Resources of Australia's Ranger mine in the Northern Territory in January 2021. However, over the longer term, Australia has the world's largest uranium resources and a range of deposits under review or development in Western Australia and South Australia, although higher prices are likely to be required to make projects viable.

Finance, information and carbon market services

The trends in global finance outlined in Part 1 will lead to growing demand for green financial services, creating opportunities for Australia's sophisticated financial services industry. In 2019–20, the financial and insurance services industry accounted for 8 per cent of Australia's GDP (ABS 2020)—Australia's second largest industry behind mining at 10 per cent. It employed 470,000 people in 2019–20 (ABS 2021c), representing around 4 per cent of employment across the Australian economy.

Global efforts are underway to develop the rules and norms that govern international sustainable finance. Australia's knowledge and expertise position it to contribute to and influence the development of such rules, including in sectors where it holds, or could hold, substantial market share. For example, Australia could influence sustainable finance rules emerging for the mining, agriculture and financial sectors, and in respect of greenhouse gas inventory and carbon accounting.

The International Platform on Sustainable Finance (IPSF) (see Part 1) is a multilateral forum enabling dialogue in respect of countries' sustainable finance plans, and is facilitating cooperation on defining what constitutes 'sustainable' investment (IPSF 2020). Australia is not currently a member. The Australian Sustainable Finance Initiative's Roadmap provides a way forward to not only leverage sustainable finance in Australia but also to help grow the sector (see Part 1 and Appendix 1, Table A1.2). Australia is well positioned to play a leading role in building international climate intelligence functions to improve adaptation and resilience efforts. It has developed a depth of knowledge and expertise in relation to climate adaptation, particularly in respect of land sector management and water security (Bamsey 2021).

Australia's public science institutions, the CSIRO and the Bureau of Meteorology (BoM), have undertaken significant work researching climate impacts and risks, and are now exploring commercial applications for their expertise. For example, through the Climate Measurement Standards Initiative, the CSIRO and BoM have recently worked with scientists from major research universities to establish guidelines to support the financial sector and regulators to assess physical climate change risks to residential and commercial property and infrastructure (Climate KIC 2020) (Case study 3.5).

Case study 3.5: CSIRO's Climate Resilient Enterprises Mission

The CSIRO's Climate Resilient Enterprises Mission was established in 2020 (CSIRO 2020). The Enterprises Mission is focused on enabling climate-ready enterprises, sustainable investments and new climate resilient industries by building core capabilities in respect of physical and transition risks and opportunities in Australia and the Asia-Pacific.

The Enterprises Mission comprises an innovation hub and a climate intelligence platform. The innovation hub is described as a virtual laboratory designed to collaborate with industry partners to develop novel and innovative market-ready climate intelligence solutions.

The climate intelligence platform is a collaboration between the CSIRO, Microsoft, Accenture and Australian SMEs. It involves the creation of a sovereign climate risk platform, the purpose of which will be to support the creation of a robust climate intelligence marketplace. Through the platform, businesses and regulators will have access to resources that allow them to carry out climate vulnerability assessments and businesses will be able to make informed decisions to build climate resilience (CSIRO n.d.).



In January 2021, the Federal Minister for the Environment committed to establish Climate and Resilience Services Australia—a new capability to prepare for and build resilience to natural disasters—and develop a new National Climate Resilience and Adaptation Strategy (Ley 2021). Australia also announced at the Climate Adaptation Summit in 2021 that it would sign onto the Coalition for Climate Resilient Investment, a flagship COP26 initiative to integrate climate-related risks into investment decision making (CCRI 2021).

Appendix 1: Investment partners' climate risk regulations and sustainable finance plans






Table A1.1: The regulation of climate-related risk in Australia's major trade and investment partners



Key


● Strong action ● Medium action ● Low or no action — Unknown






Country/Region + Criteria	Rating	Description
 Australia		
Mandatory climate-related disclosure	●	<p>The Australian Securities and Investments Commission (ASIC) and the Australian Prudential Regulation Authority (APRA) recognised the TCFD framework as best practice in 2019.</p> <p>The Corporate Governance Council of the Australian Securities Exchange (ASX) has recommended that all listed companies disclose climate risk in line with the TCFD framework, and both APRA and the ASX have endorsed guidance released by the Governance Institute of Australia on climate risk reporting.</p>
Standardised reporting (guidelines + consistent national scenarios)	●	<p>The Council of Financial Regulators (CFR) Working Group on the Financial Implications of Climate Change was established in 2017 to ensure a coordinated response to climate-related financial risks between ASIC, APRA, the Reserve Bank of Australia (RBA) and the Australian Treasury.</p> <p>APRA has outlined plans to develop a climate change vulnerability assessment that will help promote standardised reporting, due for execution in 2021. The regulatory body has also released its policy and supervision priorities for 2021, which include "updating prudential standards on operational risk, governance and risk management, and consulting with industry on guidance for climate change financial risk" (APRA 2021b).</p>
Mainstreaming	●	<p>The Australian Accounting Standards Board has recommended the TCFD as best practice and has called for consideration of climate-related risk to be fully integrated into mainstream financial considerations.</p>
International collaboration	●	<p>The RBA became a member of the NGFS in 2018, and APRA is an observer party.</p> <p>The CFR monitors and reports on relevant international developments.</p>
 European Union		
Mandatory climate-related disclosure	●	<p>The European Commission (EC) has encouraged organisations to disclosure in accordance with widely accepted reporting standards and frameworks, particularly the TCFD.</p> <p>The European Banking Authority (EBA) has, since 2019, required companies to assess the inclusion of ESG risks in their performance and evaluation.</p>

Country/Region + Criteria	Rating	Description
Standardised reporting (guidelines + consistent national scenarios)	●	<p>The EC published non-binding guidelines on reporting climate-related information in 2019, which provide a link between companies' disclosures on 'environmental matters' and the recommendations of the TCFD. In the guidelines, companies are "encouraged" to conduct scenario analysis using the TCFD's technical supplement 'The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities' (European Commission 2019a).</p> <p>The EC adopted a regulation on disclosures relating to sustainable investments and sustainability risks (disclosures regulation) in 2019, which will apply from March 2021. Under the disclosures regulation, draft regulatory technical guidelines will also be developed to "specify the content, methodologies and presentation on climate-related information" (European Commission 2019b).</p> <p>The European Financial Reporting Advisory Group created a Project Task Force on Climate-related Reporting at the request of the EC in 2019. In 2020, the task force issued a report on climate-related disclosures, identifying best practices for reporting and scenario analysis.</p>
Mainstreaming	●	In its climate-related reporting guidelines, the EC supports the TCFD's proposal that all organisations, especially asset managers and owners, implement its recommendations in their mainstream annual financial filings.
International collaboration	●	The European Central Bank, European Banking Authority, European Securities and Markets Authority and European Insurance and Occupational Pensions Authority are members of the NGFS, and the European Investment Bank is an observer party.
 United Kingdom		
Mandatory climate-related disclosure	●	<p>The UK Department for Business, Energy and Industrial Strategy (BEIS) released a Green Finance Strategy in 2019, under which it expects all companies to disclose in line with the TCFD by 2022.</p> <p>The UK Government (HM Treasury) has released an indicative roadmap towards mandatory climate-related disclosures by 2025. It endorsed the TCFD's recommendations in 2017, and has announced that it is expecting listed entities and large asset owners to disclose in line with the TCFD by 2022 under its Green Finance Strategy.</p> <p>The UK's development finance institution (CDC) and export credit agency (UK Export Finance) will make climate-related financial disclosures in their accounts in line with the TCFD recommendations "as soon as practicable following the close of the 2020-21 financial year" (UK Government 2019).</p> <p>The UK Financial Conduct Authority will require that listed companies include in their annual financial reports a statement on whether their disclosures are consistent with the TCFD, commencing 1 January 2021 (FCA 2020), and in June 2021, published new proposals on climate-related disclosure rules for listed companies and certain regulated firms (FCA 2021).</p>

Country/Region + Criteria	Rating	Description
Standardised reporting (guidelines + consistent national scenarios)		<p>The UK Government established a taskforce in 2019, chaired by the UK Treasury and comprising the UK Financial Conduct Authority, Financial Reporting Council, Pensions Regulator and Prudential Regulation Authority among other agencies, to examine the most effective way to collectively implement the recommendations of the TCFD.</p> <p>The Bank of England has endorsed the climate scenarios published by the NGFS for England's largest banks.</p> <p>In 2019, the UK Prudential Regulation Authority published a supervisory statement for UK banks and insurers, which sets out how firms should use scenario analysis to inform strategy setting and risk assessment, and develop an approach to disclosure on the financial risks from climate change. The PRA also published its Insurance Stress Test in 2019, which includes a set of climate scenarios.</p> <p>The UK Financial Reporting Council produced a report in 2019 providing practical guidance on best practice climate reporting for accountants, actuaries and auditors (FRC 2019).</p> <p>The UK Pensions Regulator released guidance for pension schemes on climate-related practices across governance, risk management, scenario analysis and disclosure in 2020.</p>
Mainstreaming		<p>The UK Government published a Green Finance Strategy in 2019, which established the Green Finance Institute (GFI). The GFI is tasked with “mainstreaming climate and environmental factors as a financial and strategic imperative”, among other things (HM Government 2020a).</p>
International collaboration		<p>The Bank of England was one of the NGFS' founding members in 2017.</p> <p>Under its mandate, the GFI will “take forward discussions with relevant international standard setters to promote internationally consistent disclosure” (UK Government, 2020).</p> <p>The UK Government has supported the creation of a new global Sustainability Standards Board, as well as work underway on harmonisation by an alliance of standard-setting organisations.</p>
 Canada		
Mandatory climate-related disclosure		<p>The Canadian Government requires public companies to disclose information that is “material” to investor decision-making, including on climate change.</p> <p>Since 2020, loan recipients under the Large Employer Emergency Financing Facility have been required to report in a manner consistent with the TCFD Recommendations.</p> <p>The Toronto Stock Exchange (TSX) included the TCFD in its “Primer for Environmental and Social Disclosure”. ESG reporting is not a TSX listing rule, however if ESG information is deemed material it must be disclosed by news release in accordance with the TMX Group's Timely Disclosures Policy (TMX Group & CPA 2020).</p>

Country/Region + Criteria	Rating	Description
Standardised reporting (guidelines + consistent national scenarios)	—	<p>In 2018, Canada's Minister of Environment and Climate Change and Minister of Finance jointly appointed the Expert Panel on Sustainable Finance, which made a series of climate-related disclosure recommendations, including a recommendation to define and pursue a Canadian approach to implementing the recommendation of the TCFD.</p> <p>The Sustainable Finance Action Council, set to launch in 2021, will make recommendations on enhancing climate disclosures.</p>
Mainstreaming	●	No action to date.
International collaboration	●	<p>The Bank of Canada became an NGFS member in 2019.</p> <p>Canada's Pension Plan Investment Board was represented on the TCFD, and has taken a leadership role in promoting the TCFD more broadly.</p>
 New Zealand		
Mandatory climate-related disclosure	●	<p>In 2020, New Zealand became the first country to adopt mandatory-climate related financial disclosure, due for implementation in 2021. The requirement will apply to publicly listed companies, large insurers, banks and investment managers.</p> <p>ESG reporting has been a listing rule of the New Zealand Stock Exchange since 2017.</p>
Standardised reporting (guidelines + consistent national scenarios)	●	The NZ Government has recommended reporting be in line with the TCFD recommendations. The Government has also committed to publishing implementation guidance, while the External Reporting Board will develop reporting standards and the Ministry for the Environment will work with regulated parties on how to undertake scenario analysis.
Mainstreaming	●	<p>In accordance with the TCFD's recommendations, NZ will require that climate-risk disclosure be included in mainstream annual (public) financial filings.</p> <p>NZ's mandatory climate-related disclosure standards are being developed by the External Reporting Board, an independent agency responsible for accounting, auditing and assurance standards in NZ.</p>
International collaboration	●	The Reserve Bank of NZ became a member of the NGFS in 2018.
 China		
Mandatory climate-related disclosure	●	<p>China has endorsed the TCFD but had not yet established mandatory disclosure requirements.</p> <p>ESG guidelines have been issued by the Shanghai, Shenzhen and Hong Kong Stock Exchanges.</p>

Country/Region + Criteria	Rating	Description
Standardised reporting (guidelines + consistent national scenarios)		<p>In 2016, seven Chinese Government agencies, including the People's Bank of China, issued national green finance policy guidelines, which require the establishment and improvement of a system for climate disclosure.</p> <p>The China Securities Regulatory Commission published uniform standards for climate disclosure by listed companies in 2016.</p> <p>The UK-China pilot has tested a series of potential climate scenario tools, and the China-side has developed a Climate and Environmental Information Disclosure Framework.</p>
Mainstreaming		No action to date.
International collaboration		<p>The People's Bank of China was a founding member of the NGFS and is a strong supporter of the Sustainable Banking Network.</p> <p>China established a UK-China pilot on climate-related and environmental risk disclosure in 2017. The UK Pact Program launched in 2018, and is designed to advance the UK-China green finance agenda through disclosure and capacity building.</p>
 Japan		
Mandatory climate-related disclosure		<p>The Japanese Financial Services Agency expects corporate entities to engage with ESG principles in corporate reporting in accordance with the Corporate Governance Code of Japan, but there is no mandatory requirement for climate-related disclosure.</p> <p>The Japanese Government is actively promoting the adoption of the TCFD at a national level through the Japan TCFD Consortium, which has led to higher voluntary uptake in Japan than in any other country around the world.</p> <p>The Japan Exchange Group, which operates the Tokyo Stock Exchange and the Osaka Securities Exchange, expressed its support for the TCFD in 2018 and actively promotes ESG investment initiatives. However, Japan's stock exchange listing regulations do not include rules for ESG disclosure.</p>
Standardised reporting (guidelines + consistent national scenarios)		<p>In 2018, Japan's Ministry of Economy, Trade and Industry prepared guidance on climate-related financial disclosures.</p> <p>The TCFD Consortium of Japan released its green investment guidance in 2019 to assist in companies in making disclosures, and updated this guidance in 2020.</p> <p>In 2019, the Japanese Ministry of the Environment released a Practice Guide for Scenario Analysis in Line with the TCFD Recommendations.</p>
Mainstreaming		Through its endorsement of the TCFD, Japan is supporting the inclusion of climate related financial disclosure in companies' annual financial filings.

Country/Region + Criteria	Rating	Description
International collaboration		<p>The Japanese Financial Services Agency joined the NGFS in 2018, and Japan hosted the first TCFD Summit in 2019 at the behest of the Prime Minister and the Japanese Minister of Economy, Trade and Industry.</p> <p>The Japan TCFD Consortium membership also comprises organisations from all over the world.</p>
 South Korea		
Mandatory climate-related disclosure		<p>Korean Government agencies announced their support for the TCFD and became a member in 2020.</p> <p>In 2021, the Korean Financial Services Commission (South Korean Government's top financial regulator) announced a series of measures to improve corporate disclosure rules in South Korea. The measures include the implementation of mandatory ESG disclosures for listed companies with total assets valued over US\$1.81 billion by 2025.</p> <p>The Korean Exchange became a member of the TCFD in 2020, and announced new mandatory ESG disclosure requirements in 2021.</p>
Standardised reporting (guidelines + consistent national scenarios)	—	The Korean Financial Services Commission has announced plans to establish “an appropriate regulatory environment” for ESG reporting, which includes the provision of guidance in the form of information on ESG disclosures.
Mainstreaming		No action to date.
International collaboration		The Bank of Korea became a member of the NGFS in 2019.

Source: Australia: APRA 2021b; NGFS 2021; Governance Institute of Australia 2020. **European Union:** Governance Institute of Australia; European Banking Authority 2018; European Commission 2019; NGFS 2021. **United Kingdom:** HM Treasury 2020a; FCA 2020; UK Government 2020b; FRC 2019; BOE 2019; HM Government 2020b. **Canada:** CEEFC 2020; TMX Group & CPA 2020; Government of Canada 2019; Lanz 2021; TCFD 2019. **New Zealand:** NZX 2017; Ministry for the Environment 2020. **China:** SSE n.d.; PBC 2016; Bank of France 2017; IFC 2021; Green Finance Initiative n.d.; UK-China Climate and Environmental Information Disclosure Pilot Coordinators 2019. **Japan:** Ikeda 2020; Ministry of Trade, Economy and Industry of Japan 2018; JPX 2018; Japan TCFD Consortium 2021. **South Korea:** The Government of the Republic of Korea 2020; SSE 2020; Tang 2021; FSC 2021.


Notes: Only actions at the federal level (or regional level in the case of the EU) are captured in this table. There may be stronger or weaker action at the state level (or in the case of the EU, at the level of individual member countries).



Table A1.2: Comparison of the sustainable finance policies and plans of Australia's key trade and investment partners



Key

- In progress (advanced stage) ● In progress/partly implemented (early stage)
● No policy or progress — Policy not endorsed by Government

Country/Region + Criteria	Rating	Description
 Australia (Private sector led. Not endorsed by Government)		
Taxonomies	—	The Australian Sustainable Finance Initiative's (ASFI) Roadmap calls for a project to explore the implementation of a sustainable finance taxonomy in Australia within a medium timeframe. The Roadmap proposes a broad group of stakeholders be involved in the development of the taxonomy, including civil society, asset owners, asset managers, banks, insurers, financial regulators, legal experts, industry experts, technology experts, sustainability experts, state governments, and the Australian Government.
Standards and labels	—	The Roadmap recommends financial system participants work with Government financial system regulators to develop guidance on sustainable benchmarks and indices.
Governance arrangements	—	The Roadmap sets out making the ASFI a permanent body with a board comprising industry representatives and an advisory council composed of Government regulators, industry bodies and civil society representation.
International engagement and coordination	●	Australia is not currently involved with the International Platform on Sustainable Finance (IPSF) but is engaged through other forums including the Network for Greening the Financial System (NGFS). The Roadmap recommends establishing international partnerships to support implementation of the Roadmap.
Initiatives to grow low carbon investment	●	<p>The Roadmap recommends a number of actions aimed at supporting development of a sustainable capital market in Australia however these have not be formally considered by the Government.</p> <p>Through ARENA and the CEFC the Australian Government is leveraging private sector finance through providing grants and financing respectively to clean energy projects.</p>
 European Union (Government initiative with private sector input)		
Taxonomies	●	The 'EU Taxonomy' classification system sets out the conditions that an activity has to meet in order to be environmentally sustainable. The framework for the EU Taxonomy was established in July 2020 and a list of sustainable activities that substantially contribute to climate change mitigation or climate change adaptation are to be adopted in 2021 (see Part 1 Box 1.5).
Standards and labels	●	The European Commission will develop European sustainable finance standards and labels for green financial products (Action 2 of the Commission's Action Plan), starting with developing a voluntary EU Green Bond Standard for which consultation has been undertaken. The EU Green Bond Standard will aim to enhance the effectiveness, transparency, comparability and credibility of the green bond market and to encourage market participants to issue and invest in EU green bonds.

Country/Region + Criteria	Rating	Description
Governance arrangements	●	The European Commission has established several expert groups with specific mandates to progress sustainable finance. These include a High-level expert group on sustainable finance, a technical expert group, and a Members states' expert group on sustainable finance.
International engagement and coordination	●	The EU, along with other aligned nations, launched the IPSF in 2019 and is a member of the NGFS. The EU is working on sustainable finance with other countries, including China.
Initiatives to grow private low carbon investment	●	The European Green Deal Investment Plan announced the EU will mobilise at least € 1 trillion of private and public sustainable investments over the next decade. In addition to the above initiative and work in prudential regulation, initiatives designed to grow low carbon investment include issuing green bonds, delivering funding through the EU Investment Bank, leveraging public and private investment by de-risking investment through providing an EU budget guarantee and using revenue from Emission Trading System (ETS) auctions for climate related projects.
 United Kingdom (Initiated jointly between government and the private sector. Endorsed by government)		
Taxonomies	●	The UK has announced it will be implementing a green taxonomy based on the metrics and thresholds in the EU taxonomy. A new UK Green Technical Advisory Group will review these metrics for use in the UK market.
Standards and labels	●	The British Standards Institution (BSI) is rolling out its Sustainable Finance Standardisation Programme, a five year long initiative 'focused on the development of globally relevant, consensus-based standards on the subject of sustainable finance' (BSI n.d.). Specifically this will include building a broad consensus on common use of definitions, methodologies and reporting measures. The BSI have finalised two relevant standards and are working on a third that will set out requirements for the assessment, governance, labelling and communication of funds presented as having sustainable credentials.
Governance arrangements	●	The UK Government has established the independent Green Finance Institute (GFI) as the principal forum for collaboration between the public and private sector with respect to green finance. The GFI will play an integral role in supporting delivery of the Green Finance Strategy and driving the mainstreaming of green finance in the UK and abroad. The Bank of England and other government departments are also supporting sustainable finance in the UK.
International engagement and coordination	●	The UK, through its 2021 Presidency of the G7 and Presidency and host of COP26, is expected to use its position to champion sustainable finance initiatives. The UK has made finance one of five key campaigns for COP26. The UK is working with governments such as China, Brazil, India and Mexico to develop green finance markets. The UK is a member of the IPSF and NGFS.
Initiatives to grow private low carbon investment	●	The UK Government's Ten Point Plan for Green Industrial Revolution and its Clean Growth Strategy set out a large number of policies aimed at leveraging green private investment, investing in new technologies and targets for offshore wind energy generation. In its Ten Point Plan the UK Government has announced, subject to market conditions, it will issue the UK's first sovereign Green Bond in 2021.

Country/Region + Criteria	Rating	Description
 Canada (Private sector led and partially endorsed by Government)		
Taxonomies	●	The Expert Panel on Sustainable Finance recommended that the Canadian Government adopt an international green taxonomy that aligns with its global investment and trade priorities before working either independently, or with other countries with similar resource endowments, to develop supplemental coverage for industry transition activities that are essential to Canada but not captured under current criteria. The Government has now launched a new Sustainable Finance Action Council to further pursue work in this area.
Standards and labels	●	The Canadian Government has provided funding for the Sustainable Finance Action Council with the Council set to make recommendations on a number of initiatives including on developing standards for identification of sustainable investments.
Governance arrangements	●	The Expert Panel advised the government to establish a Sustainable Finance Action Council to help implement its recommendations. The government recently allocated C\$7.3 million over three years to create the Action Council that has now been launched.
International engagement and coordination	●	Canada, along with other aligned nations, launched the International Platform on Sustainable Finance in 2019. It is a member of the NGFS.
Initiatives to grow private low carbon investment	●	The Expert Panel has proposed a number of measures to unlock private low carbon investment including financial incentives for Canadians to invest their superannuation into green finance products. The Canadian Government has funded the Action Council to develop standards to identify sustainable investments and has announced funding initiatives including for renewable energy that are likely to further unlock private investment.
 New Zealand (Private sector led. Partially supported by Government)		
Taxonomies	●	The Sustainable Finance Forum's Roadmap for Action recommends that sustainable standards be created for providing objective definitions of sustainable activities in New Zealand. These sustainable standards will be harmonised with leading international standards including the EU Taxonomy and the Climate Bonds Initiative Standards.
Standards and labels	●	The Forum made several recommendations on developing standards for both social and environmental factors for the purpose of providing objective definitions of sustainable activities for investment, lending and insurance. This includes an initiative for defining sustainable agriculture based on existing local standards and alignment with international financial definitions.
Governance arrangements	●	The Roadmap includes a recommendation to establish an independent Centre for Sustainable Finance that would oversee and coordinate implementation of the Roadmap.
International engagement and coordination	●	New Zealand is engaged internationally through the IPSF and closely collaborates with the Australian Sustainable Finance Initiative. It is a member of the NGFS.
Initiatives to grow private low carbon investment	●	The Roadmap recommends a number of initiatives, including aligning the voluntary KiwiSaver (superannuation) scheme with funds aligned with environmental, social and governance standards. The New Zealand Government is also supporting public sector financing to facilitate transformation through New Zealand Green Investment Finance.

Country/Region + Criteria	Rating	Description
 China (No overarching sustainable finance plan. Government led)		
Taxonomies	●	China's green bond guidelines do not have metrics and thresholds comparable to the EU taxonomy, although they have been referred to as a 'green taxonomy'. It has been suggested that China's proposed new catalogue (see standards and labels) may act as a green taxonomy.
Standards and labels	●	<p>The Peoples' Bank of China and the National Development and Reform Commission (NDRC) issued their respective guidelines for green bond issuance (defining criteria and categories for green bond projects) in 2015—though these lack metrics or thresholds. The criteria behind these guidelines have been a point of contention as they allow finance to coal. The China Securities Regulatory Commission issued separate guidelines in 2017. All three approaches cover different areas of the bond market.</p> <p>A consolidation of these approaches has been proposed in a draft new 'Green bonds endorsed catalogue'. The draft catalogue excludes fossil fuels, which would remove a barrier to green investment.</p>
Governance arrangements	●	China has set up a Green Finance Committee, with 200 members, to facilitate policy research, raise awareness, develop products and tools and catalyse international cooperation.
International engagement and coordination	●	<p>China is a founding member of the IPSF and the NGFS. China was co-chair of the Green Finance Study Group and has been appointed co-chair of the restarted Sustainable Finance Study Group.</p> <p>The China Green Finance Committee (CGFC) and the European Investment Bank have worked on comparing their green standards and possibilities for convergence.</p>
Initiatives to grow private low carbon investment	●	Government policy banks have issued green bonds (not sovereign bonds)—however these have been relatively minor to date—around 3 per cent. Green investment principles for the Belt and Road initiative have also been endorsed by 30 financial institutions.
 Japan (No overarching sustainable finance plan)		
Taxonomies	—	Japan has not yet developed a taxonomy but Japan's Transition Finance Study Group—a non-profit group of researchers—have proposed a "transition taxonomy", focusing on debt financing and seeking to classify projects, assets and activities that can transition from high to low carbon in addition to strictly green activities.
Standards and labels	●	Japan published Green Bond Guidelines in 2017 and issuance of green bonds has grown significantly in Japan. However, there is no single taxonomy governing what constitutes sustainable investment.

Country/Region + Criteria	Rating	Description
Governance arrangements	●	In 2018 the Green Finance Network Japan was launched as a public/private group to share information on green finance and connect with international stakeholders. In late 2020, Japan's Financial Services Agency announced it will establish an Expert Panel on Sustainable Finance to support the transition to a carbon neutral economy. The Panel will be composed of business, financial and academic experts, with government support.
International engagement and coordination	●	Japan is a member of the IPSF and the NGFS.
Initiatives to grow private low carbon investment	●	There has been some progress on initiatives to directly grow low carbon finance. The Government Pension Investment Fund, the world's largest pension fund, has adopted an ESG strategy and is working with the World Bank, Asian Development Bank and other investment banks internationally to promote green bonds.
 South Korea (No overarching sustainable finance plan)		
Taxonomies	●	Korea has announced that it will develop a 'K-taxonomy' to identify green industries and activities in 2021. It has progressed work in classification that is underpinning the developments in standard and labels. Korea's long-term strategy states that the Government 'plans to establish a guideline for environmentally responsible investments for private sector investors' and to 'build up a taxonomy for green finance to channel financial flows into the businesses with real environmental benefits.'
Standards and labels	●	Korea has developed green bond guidelines that allow companies that follow the guidelines to list as green bonds on the Korea Exchange (KRX). In late 2020, the KRX launched a "K-NewDeal index" and a "carbon efficiency green index" with the former designed to identify and direct investment to companies involved in digital and green reforms including the energy transition e.g. batteries, and the latter directing investment to companies with relative low carbon emissions.
Governance arrangements	●	The Korean Financial Services Commission launched a Green Finance Taskforce in August 2020 to help the sector integrate climate-related risk into financial monitoring, promote investment in green industries and participate in global green finance networks.
International engagement and coordination	●	South Korea is a member of the NGFS, and is not a member of the IPSF.
Initiatives to grow private low carbon investment	●	As part of Korea's Green New Deal (totalling US\$64 billion investment by 2025 on clean infrastructure, energy and new technologies), US\$1.7 billion will be made available to businesses as loans to invest in a green transition.

Source: Australia: ASFI 2020, *Australian Sustainable Finance Roadmap*; European Union: European Commission n.d.c., *Sustainable Finance*; EIB 2018. United Kingdom: UK Government 2019, *Green Finance Strategy: Transforming finance for a greener future*; UK Government 2018, 2020b; HM Treasury 2020b; BSI n.d.; UK COP26. Canada: Government of Canada 2019, *Final report of the Expert Panel on Sustainable Finance—Mobilizing Finance for Sustainable Growth*; Government of Canada 2020. New Zealand: The Aotearoa Circle 2020, *Roadmap for Action Final Report 2020*; NZGIF n.d. China: OECD n.d.b; Climate Bonds Initiative 2020; Bloomberg News 2020; Paulson Institute 2019; G20 Italia 2021b; EIB 2018; Columbia University n.d. Japan: Milburn 2020; Schumacher et al. 2020; Schroders 2021. South Korea: He-Suk 2020; The Government of the Republic of Korea 2020; Republic of Korea Financial Services Commission 2021; KRX n.d., Schroders 2021, Republic of Korea Ministry of Economy and Finance 2020.

Appendix 2: The outlook for Australia's key energy exports

Thermal coal

Australia is the world's second largest exporter of thermal coal, and exports were worth A\$20 billion in 2019–20 (DISER 2020c). The coal mining industry (including metallurgical coal miners) currently employs around 48,000 people (ABS 2021c).

There are numerous scenarios for the future global energy mix in 2050 that are consistent with the Paris Agreement's goal of limiting global warming to 2°C, and all see thermal coal consumption fall sharply. Under BloombergNEF's NEO Climate Scenario (Part 1, Table 1.7), coal accounts for less than 1 per cent of electricity generation in 2050 (BloombergNEF 2020). Under the IEA's Sustainable Development Scenario (Part 1, Table 1.7), almost all generation from coal-fired power plants without carbon capture is phased out by 2030 in advanced economies and by 2045 in developing economies, and coal generation with carbon capture plays only a minor role (IEA 2019a). In the IEA's Net-Zero by 2050 Scenario, the transition away from coal in power generation is faster still: all subcritical coal-fired power plants are phased out by 2030, and all plants without CCUS by 2040 (IEA 2021a).

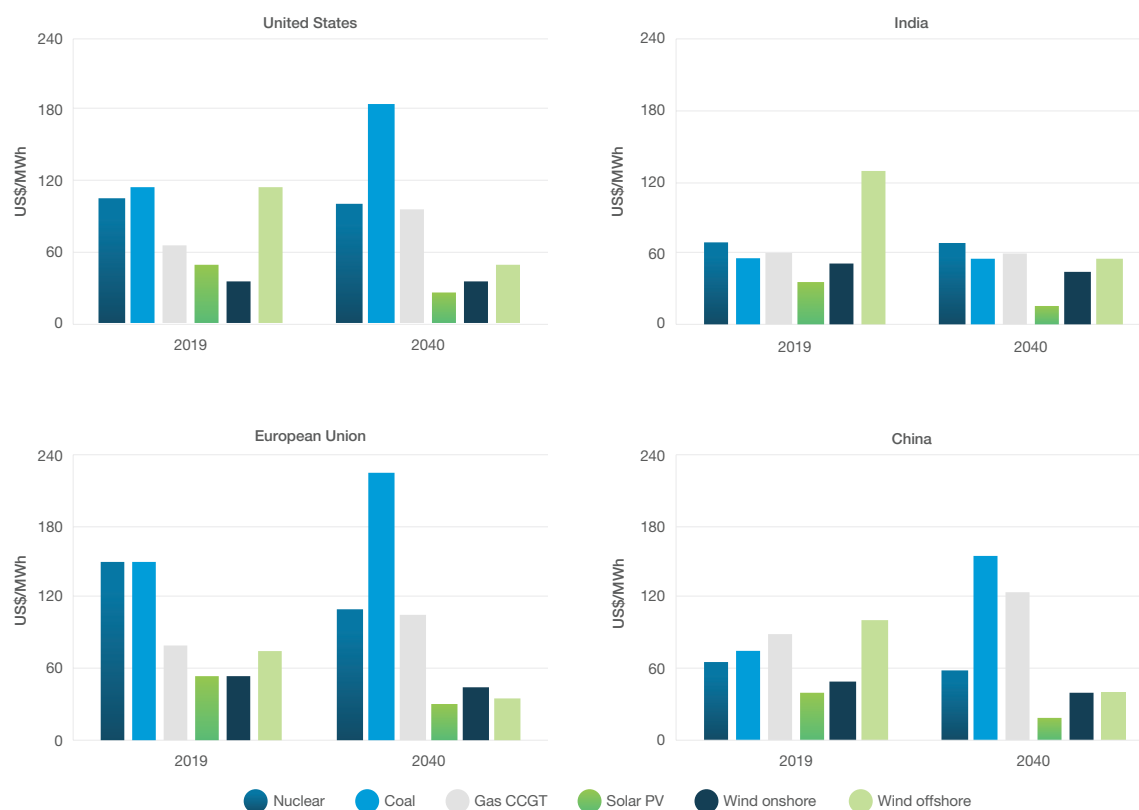
A key driver of declining thermal coal use in these scenarios is the availability of commercial substitutes in the form of renewable energy, firmed by gas, hydropower or batteries. Solar has already emerged as the cheapest source of new electricity in some parts of the world (IEA 2020c; Manghani 2021). In 2019, the cost of new solar and onshore wind generation was lower than the cost of new coal generation in major economies like the United States, the European Union, China and India (Figure A2.1). As the world moves to net zero, costs for new coal generation projects will likely increase further while the cost of renewable generation such as wind and solar will continue to fall (IEA 2020c).

Australia's thermal coal exports are highly vulnerable to the pace of the global shift to a low emissions economy. Thermal coal is an especially emissions intensive way to generate energy, and as such, is the first fossil fuel to be phased out of the global energy mix on a Paris-aligned decarbonisation pathway (IPCC 2018; IEA 2020b; BloombergNEF 2020).

The prospects for Australia's thermal coal exports are further complicated by the fact that Australia's three largest export markets have committed to reaching net zero by mid-century: Japan, China (2060) and South Korea. Around three quarters of Australia's thermal coal exports currently go to countries with a mid-century net zero target. There may be opportunities for Australia to capture new export markets for its thermal coal in coming years (Cunningham et al. 2019), but a decarbonisation pathway aligned with a 2°C implies sharp falls in Australia's thermal coal exports.

The employment implications of declining demand for both thermal coal and metallurgical coal (discussed below) are likely to be acute for some regional areas, where the wider regional economy is integrated with coal mining. New South Wales accounts for the majority of Australia's thermal coal exports, with major coal producing areas including the Hunter Valley and Gunnedah regions (DISER 2020a). A proactive approach to managing these challenges would help address the impacts of the global energy transition on local communities.

Figure A2.1: Technology costs in the IEA's Sustainable Development Scenario



Source: IEA 2020c.

Notes: Levelised Cost of Electricity (LCOE) shown. LCOE is a measure of the average cost of electricity from a new electricity generation project over its lifetime; CCGT stands for combined cycle gas turbine.

Metallurgical coal

Australia is the world's largest exporter of metallurgical coal, with exports worth A\$34 billion in 2019–20 (DISER 2020c). Unlike thermal coal, which can be readily replaced by low carbon energy sources to generate electricity, metallurgical coal—used in the production of iron and steel—does not yet have commercially viable technologies to replace it.

On a Paris-aligned decarbonisation trajectory, global demand for metallurgical coal would decline in coming decades. Coal currently accounts for 75 per cent of the energy inputs for iron and steel and is a major source of the sector's emissions (IEA 2020e).

In the short term, technology performance improvements of conventional production methods and demand reduction through material efficiency will play a key role in reducing emissions from the iron and steel sector, accounting for an estimated 90 per cent of emissions reductions over the period to 2030 (IEA 2020e).

Over the longer term, there are several low emissions production technologies that could help to decarbonise iron and steel production, such as hydrogen, CCUS, bioenergy and direct electrification (IEA 2020e).

By 2040, world metallurgical coal production would fall by over 50 per cent on a decarbonisation trajectory consistent with limiting global warming to 2°C (IEA 2020e), with further declines likely thereafter. While metallurgical coal may remain in use for some time on a Paris-aligned decarbonisation trajectory, it would be on a much smaller scale than today with intense competition among producers for remaining demand.

Large-scale declines in global demand for metallurgical coal would see Australia's exports contract. Three of Australia's four largest export markets for metallurgical coal have net zero targets (Japan, China and South Korea), though its second largest market, India, does not. Around two-thirds of Australia's metallurgical coal exports are covered by mid-century net zero targets.

Australia's exporters of semi-soft coking coal and pulverized coal for injection (types of metallurgical coal), which sit higher on the global cost curve than Australia's hard coking coal producers, are particularly vulnerable (DISER 2020a). Impacts will be felt most acutely in Queensland, which accounts for the bulk of Australia's metallurgical coal exports.

Natural gas

Australia rivals Qatar as the world's largest LNG producer (DISER 2020c). Australian LNG exports were worth A\$48 billion in 2019–20, and the oil and gas sector currently employs 29,000 people (ABS 2021c). Although natural gas consumption could increase to 2025 on a Paris-aligned decarbonisation trajectory, demand would need to have fallen by around 19 per cent on 2018 levels by 2050 to be consistent with limiting warming to 2°C (Figure 3.5) (IEA 2019b).

There is a risk that a global shift away from gas could be faster. BloombergNEF maps a scenario where warming is held to less than 2°C, but where gas accounts for just 6 per cent of global energy demand by 2050, down from just under a quarter today, with hydrogen replacing gas in key end use sectors (Figure 3.5). Similarly, under the IEA's Net-Zero by 2050 Scenario where warming is limited to 1.5°C, natural gas represents just 11 per cent of the global energy mix in 2050 (IEA 2021a).

There may be opportunities for Australia to capture new markets for LNG as countries move towards net zero. However, declining global gas demand will have implications for both existing gas export projects and future gas developments in Australia. Australia has 10 existing LNG projects, five of which are based in Western Australia, three in Queensland and two in the Northern Territory (DISER 2020c). Around three-quarters of Australian gas is exported under long term contracts (DISER 2020). As these contracts expire, Australian LNG exporters could be increasingly exposed to competition in a shrinking market. Over four-fifths of Australia's LNG is exported to countries with a mid-century net zero target in place. The future gas developments most at risk will be those with long payback periods.

Acronyms

AAPowerLink	Australia-Asia PowerLink
ABARES	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACCR	Australasian Centre for Corporate Responsibility
ADB	Asian Development Bank
APRA	Australian Prudential Regulation Authority
AREH	Asian Renewable Energy Hub
ASEAN	Association of Southeast Asian Nations
ASFI	Australian Sustainable Finance Initiative
ASIC	Australian Securities and Investments Commission
ASX	Australian Securities Exchange
BEIS	Department for Business, Energy and Industrial Strategy (United Kingdom)
BOE	Bank of England
BOK	Bank of Korea
BOJ	Bank of Japan
BoM	Bureau of Meteorology
BSI	British Standards Institution
CBAM	Carbon border adjustment mechanism
CCA	Climate Change Authority
CCS	Carbon capture and storage
CCUS	Carbon capture, utilisation and storage
CEFC	Clean Energy Finance Corporation
CFR	Council of Financial Regulators
CFTC	Commodity Futures Trading Commission (United States)
CO ₂	Carbon dioxide
CO ₂ -e	Carbon dioxide equivalent
COAG	Council of Australian Governments
COP	Conference of the Parties
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DFAT	Department of Foreign Affairs and Trade
DISER	Department of Industry, Science, Energy and Resources

EBA	European Banking Authority
EC	European Commission
ECB	European Central Bank
ESG	Environmental, social and corporate governance
ETS	Emissions trading scheme
FDI	Foreign Direct Investment
FFI	Fortescue Future Industries
FSB	Financial Stability Board
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GRI	Global Reporting Initiative
GW	Gigawatt
HVDC	High-voltage direct current
IEA	International Energy Agency
IEEFA	Institute for Energy Economics and Financial Analysis
IFRS	International Financial Reporting Standards
IGCC	Investor Group on Climate Change
IIA	International Investment Agreement
IPCC	Intergovernmental Panel on Climate Change
IPHE	International Partnership for Hydrogen and Fuel Cells in the Economy
IPSF	International platform on sustainable finance
KRX	Korea Exchange
kWh	Kilowatt hour
LCOE	Levelised cost of electricity
LNG	Liquid natural gas
MLA	Meat and Livestock Australia
NAFTA	North American Free Trade Agreement
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission (People's Bank of China)
NEO	New Energy Outlook
NGFS	Network for Greening the Financial System
OECD	Organisation for Economic Co-operation and Development
PACE	Partners for a Clean Environment
PBOC	People's Bank of China
PV	Photovoltaic

RBA	Reserve Bank of Australia
RBNZ	Reserve Bank of New Zealand
SBTs	Scenario analysis and science-based targets
SBTi	Science Based Targets initiative
SME	Small to medium enterprise
TCFD	Task Force on Climate-related Financial Disclosures
TSX	Toronto Stock Exchange
TNFD	Task Force on Nature-related Financial Disclosures
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USMCA	United States–Mexico–Canada Agreement
UNEP	United Nations Environment Programme
WBG	World Bank Group
WGEH	Western Green Energy Hub
WRI	World Resources Institute
WTO	World Trade Organisation

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