



Green Infrastructure Investment Opportunities

AUSTRALIA 2019



Sponsors

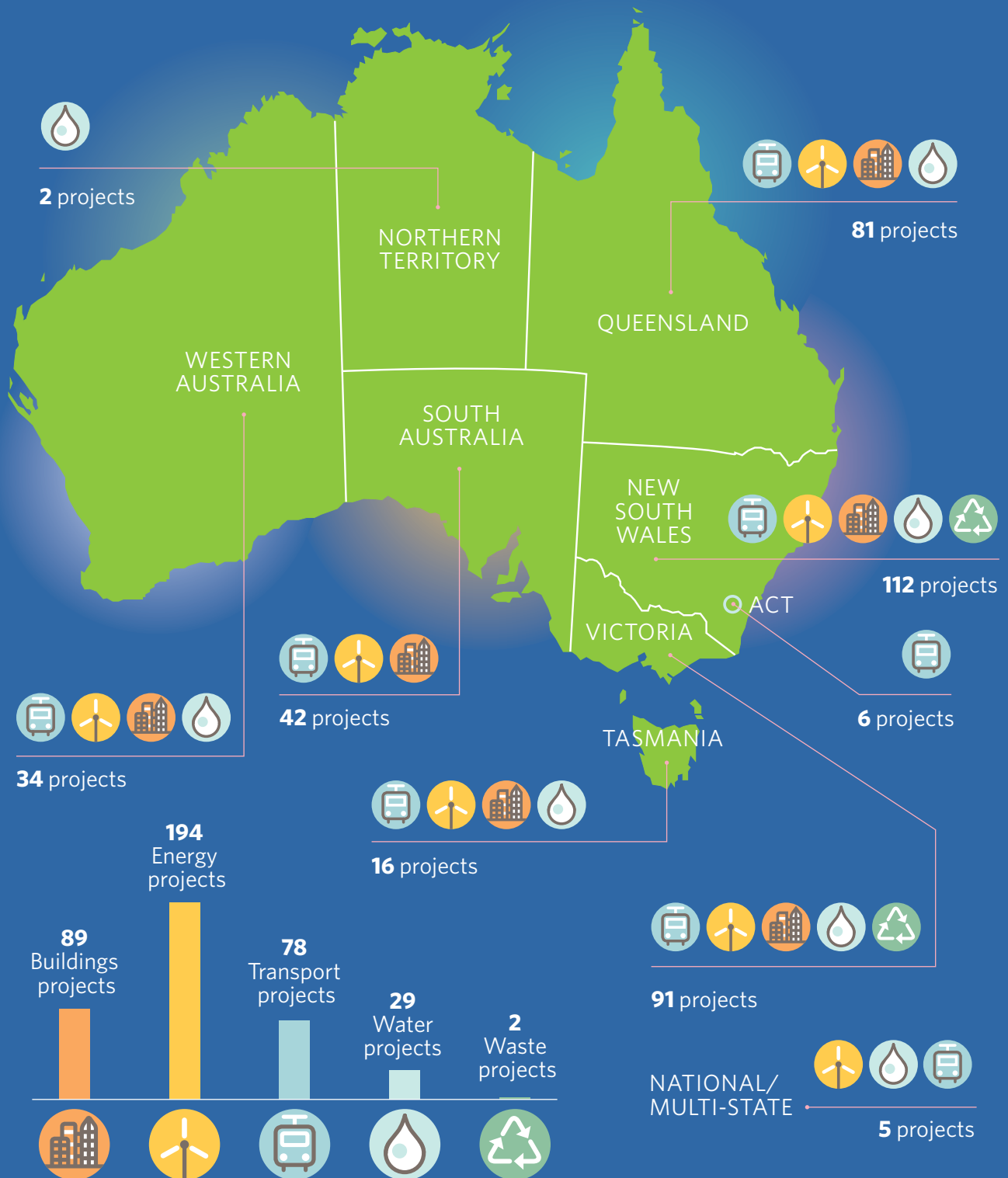
The 2020s green infrastructure pipeline



Wind: 6.9MW with a total investment of over AUD10.6bn



Solar: 8.3MW with a total investment of over AUD 14.5bn¹



Green infrastructure: Opportunity & Growth

Introduction

Green infrastructure presents a huge investment opportunity across the world, with an estimated USD100tn worth of climate/compatible infrastructure required globally by 2030 in order to meet Paris Agreement emissions reduction targets.

The effects of climate change and the risks associated with a greater than 2°C rise in global temperatures by the end of the century are significant: rising sea levels, increased frequency and severity of weather events, droughts, wildfires, loss of biodiversity and changes in agricultural patterns and yields.

Investment in low carbon solutions will be essential for meeting global emissions reduction pathways under the Paris Climate Change Agreement.

Over the past few years, there has been an increasing demand from institutional investors, particularly from OECD nations, for investment opportunities that address environmental challenges and support sustainable development. Institutional investors and banks have over USD120tn assets under management that can potentially be used in part to support infrastructure investment and upgrades.

The growing level of interest from investors in both environmental and social projects has resulted in the development and growth of innovative financial products.

The global green bond market in particular has grown rapidly, with issuance in 2018 surpassing USD165bn. However, green finance needs to scale up much further to achieve global climate targets and infrastructure needs.

This report builds on the inaugural *Green Infrastructure Investment Opportunities Australia and Zealand* (GIIO) report released in August 2018. It provides updated content specifically for Australia to help meet the growing demand for green & ESG investment opportunities, including green bonds, as well as to support the country's transition to a low carbon economy. It aims to facilitate greater engagement between project owners, governments and institutional investors. A similar report for New Zealand has been produced separately.

The report is intended for a wide range of stakeholders in Australia, including domestic superannuation funds and asset managers and their global counterparts, potential issuers, infrastructure owners and developers, as well as relevant state and federal ministries including Finance, Planning, Energy, Transport and Environment.

Methodology

The report considers five key sectors: renewable energy, low carbon transport, sustainable water management, sustainable waste management and green buildings. We use the Climate Bonds Taxonomy (see back cover) to identify which projects and assets are green.

The objective of this report is to identify large infrastructure projects, the following filters were also applied:



Renewable energy: generation facilities above 50 MW



Low carbon transport: projects valued above AUD100m



Sustainable water management: projects valued above AUD50m



Sustainable waste management: projects valued above AUD50m



Green buildings: 6-star rated Green Star properties under the Green Buildings council of Australia

There are various ways for an investor to gain exposure to a specific project, asset or portfolio. The possible investment pathways will vary depending on the asset ownership structure, the stage in the asset's financing lifecycle, and the investor's mandate. This can vary between projects with public and private funding.

Accordingly, further metrics were used to classify the green infrastructure investment opportunities by status:

- **Completed projects:** high profile, recently completed projects;
- **Projects under construction:** major projects that are under construction; and
- **Planned projects:** major projects that have not yet begun construction but have been announced and/or have undergone business case planning and/or have been allocated budget.

The 2019 list of green projects from public pipelines is available as a supplement on the report webpage on the Climate Bonds website. Case studies have been developed in this report to show the different types of opportunities available in the short- and medium-term future in Australia.

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The majority of transport and water projects have been drawn from the Australia New Zealand Infrastructure Pipeline (ANZIP) and Infrastructure Australia's Priority Project List. The majority of energy projects were identified from a number of sources including the Clean Energy Regulator and Australian Renewable Energy Agency (ARENA).

The Green Buildings projects were chosen from the Green Buildings Council of Australia Green Star database. While buildings were included in the initial report and we have included commentary on the sector in this update, future reports will focus only on more 'traditional' infrastructure sectors. Building rating schemes are well-established in Australia, making low carbon buildings easy to identify. Australian property owners are already financing such buildings, increasingly in the green bond market, mostly under the Climate Bonds Buildings Criteria.² Climate Bonds will continue to cover buildings, including country level information in its sector coverages, e.g. through dedicated briefings.³

Acknowledgements

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In developing this report, the Climate Bonds Initiative also consulted with key Government bodies, industry, the financial sector, peak bodies, NGOs and think tanks. We would like to thank Cbus, CEFC, HESTA, IFM Investors, the Green Building Council of Australia, GRESB and Responsible Investment Association of Australasia for their comments and content support.

Australia infrastructure overview

Australia stands at a crossroads on national development. An increasing range of voices, including the Reserve Bank of Australia (RBA), are calling for expanded infrastructure investment.^{4,5} Meanwhile, emissions continue to rise and issues around the nation's climate stance remain unresolved as pressures on energy, transport, urban congestion, water and service delivery continue to grow.

The Australian Infrastructure Plan (2016) emphasises that sustainability and resilience should not be seen as fringe concepts.⁶ In 2019, despite some progress,⁷ it is clear that sustained emissions reduction has not yet been effectively integrated into national infrastructure priorities, let alone adaptation and resilience measures for assets to withstand increasingly volatile climactic conditions.⁸

While overall progress has been slow, there has been an increase in some green infrastructure including a boom in small- to large-scale solar capacity. Sustainability in commercial and public sector building design has also become mainstream.

However, traditional high-carbon infrastructure investments remain central to the economy including coal-fired power generation, LNG and rail and ports expansion to facilitate fossil-fuel industries.

Australia's per capita CO₂ emissions are one of the highest in the world. Further, infrastructure-related emissions account for more than half of the country's total greenhouse gas (GHG) emissions: 35% from the electricity sector and 18% from the transport sector.⁹

Australia ratified the 2015 Paris Agreement, committing to making finance flows consistent with a pathway towards low carbon and climate resilient development. Australia's Nationally Determined Contribution (NDC) under the Paris Agreement is a reduction in annual national greenhouse gas emissions of 26-28% below 2005 levels by 2030.

To reduce emissions, with the ultimate goal of reaching zero carbon, state and federal governments, the financial sector and industry all need to increase their emphasis on the provision of low carbon, sustainable and resilient infrastructure. A greater share of private sector investment is considered crucial in doing so.

There is now a growing opportunity for new partnerships between government and investors to participate jointly in green infrastructure investment, through expanded green finance mechanisms.

Simultaneously, investing in green infrastructure will help Australia to reach

existing and new climate targets, spur innovation, address congestion, broaden the economic base, improve productivity and promote a more sustainable national economic and social development model.

Green finance trends

Green bonds continue to be the primary means of gaining exposure to green finance in the fixed income market. Cumulative issuance from Australian entities as of H1 2019 reached AUD15.6bn, placing Australia 11th in global rankings and 3rd in Asia-Pacific.¹⁰ Issuance was almost AUD6bn in 2018 and has already passed AUD4bn in August 2019.

Australia's major banks have pioneered green finance, adopting and promoting international best practice in green issuance and supporting new issuers. Innovative structures have emerged, including the creation of new green investment products designed to appeal to investors with different risk appetites. This includes green and sustainability-linked loans and green retail deposit products.

Green bond issuers - particularly the large banks and State Treasury Corporations - have used green bonds both as a market signal around green policy and to meet increasing investor demand, tapping the market to refinance pools of existing eligible assets.

Financial regulators Australian Prudential Regulation Authority (APRA), Australian Securities and Investment Commission (ASIC) and the Reserve Bank of Australia (RBA) have all endorsed the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and warned of systemic climate risks. This is part of a global trend for financial regulators such as the Bank of England and others.¹¹

The formation of the **Australian Sustainable Finance Initiative** (ASFI) will also provide further impetus to green and sustainable investment.

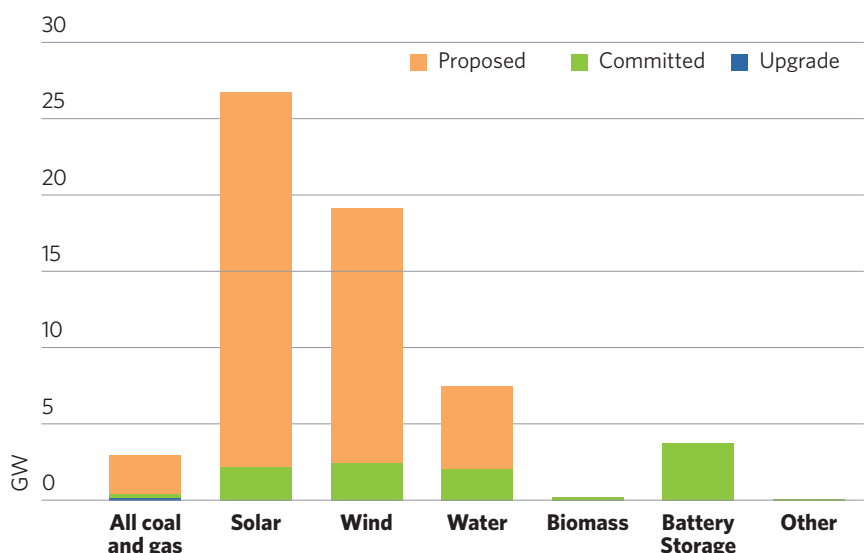
Australian Sustainable Finance Initiative

The Australian Sustainable Finance Initiative was established in 2019 to set out a roadmap for 'realigning the finance sector to support greater social, environmental and economic outcomes' for Australia.

It brings together leaders from banks, superannuation funds, insurance companies, financial sector peak bodies, NGOs and academia with the aim of developing a Sustainable Finance Roadmap.

The roadmap will be launched in 2020 and will recommend pathways, policies and frameworks to enable the financial services sector to contribute more systematically to the transition to a more resilient and sustainable economy. It is intended to be consistent with global goals such as the UN Sustainable Development Goals and the Paris Agreement on climate change.

Solar and wind projects dominate energy capacity addition pipeline



Data Source: AEMO[®]

Why green infrastructure?

The Climate Action Tracker has rated Australia's commitment under the Paris Agreement as insufficient, highlighting the infeasibility of meeting the target due to a lack of climate policies and an ongoing reliance on fossil fuels. The energy sector has the highest carbon intensity of any country in the G20. Australia is also singularly under-prepared for a future tightening of global targets.

Despite some state-based commitments, a transition to a zero-carbon economy is not yet under active consideration or implementation by many domestic policy makers and corporations. Delayed action increases the cost of change as well as the volatility and structural risks to the finance sector and underlying asset values.

In this national environment, major stakeholders in banking, finance and superannuation have a responsibility to act. Adaptive and resilient infrastructure provision on an accelerated basis should become a core part of the national response to the coming climate emergency. Australia has all the necessary building blocks and expertise in the finance sector and capital in its retirement pool for this acceleration to take place.

A bigger role for superannuation

Major infrastructure projects have been and many will likely continue to be financed through bank finance (particularly energy and transport sectors) or through government budgets (particularly water and waste sectors).

While such finance will continue to play a major role in funding, Australia's superannuation sector, already a global presence in alternative investment, is increasingly looking for opportunities to expand its role in the domestic economy.

This includes the long-term funding and operation of large-scale infrastructure assets in partnership with both government and the private sector to achieve more productive capital allocation, driving sustainable growth.¹²

The largest superannuation funds, with several decades of infrastructure experience and a permanent ownership presence in the ASX are also seeking wider partnership roles with both government and the private sector.

This patient and growing pool of retirement capital is yet to be effectively harnessed for large-scale domestic infrastructure investments.¹³ The energy sector, where

2020s Asia-Pacific Green Finance Centres



When a central bank, a prudential regulator and a conduct regulator, with barely a hipster beard or hemp shirt between them, start warning that climate change is a financial risk, it's clear that this position is now orthodox economic thinking... Companies that delay or avoid adjusting to new economic realities, no matter how famous or successful, can quickly find themselves on the verge of a Kodak moment.

Geoff Summerhayes, Executive Board Member of APRA¹⁹

despite widespread support the transition to clean energy generation has been delayed by political inertia, is an obvious initial target. Other sectors for increased investment include transport, housing, waste and water.

Australia has the foundations to expand green infrastructure provision throughout the 2020s and beyond. Few nations enjoy this confluence of positive circumstances: a robust banking sector with green finance expertise, a superannuation sector with proven infrastructure capability and willingness to explore new investment models, and widespread community support for increased government borrowing combined with new infrastructure investment partnerships involving domestic institutional investors.

Integration with Asia's green finance future

Tokyo, Hong Kong, Shanghai and Singapore are positioning themselves to become green finance hubs as Asian nations look towards green finance to help meet their infrastructure, sustainable development, energy and climate goals.¹⁴ The ADB estimates regional infrastructure investment requirements of USD1.7tn per annum.¹⁵ The 2018 Indonesia GIIO report reflects the scale of opportunities in a near neighbour.¹⁶

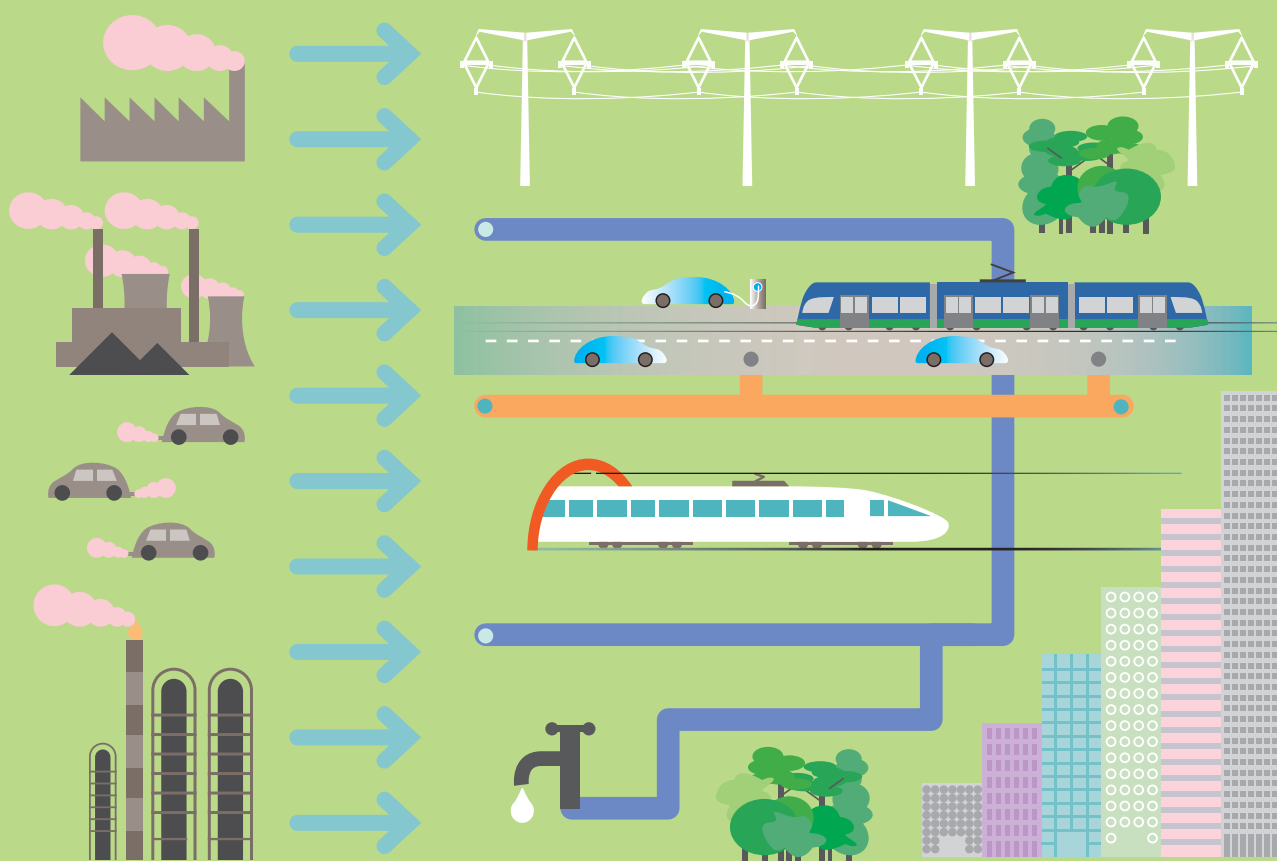
Australia has both the capacity and opportunity to anchor the southern tip of this arc of green finance centres that will emerge in the early 2020s.

Australia's banks and superannuation funds have the combination of green finance and infrastructure expertise, regional experience, size and long-term investment horizons required to support increased investment in green infrastructure across the Asia-Pacific.

An expanding green domestic market helps build the platform for Australia to become a significant exporter of both green expertise and infrastructure capital into the region. Improved integration with Australia's regional foreign policy engagement could provide a further pillar.¹⁷

Programmes to assess investability of national climate project pipelines or initial co-investment with regional Multi-lateral Development Banks (MDBs) and Development Finance Institutions (DFIs) may also offer potential for new engagement and cooperative partnerships in the region.

Brown to green transition in Australia



Global green investment opportunities are growing and yet there remains a scarcity of offerings, pointing to a lack of supply of green issuance particularly from non-financial corporates, i.e. the real economy.²⁰

Furthermore, segments of the real economy, that offer significant emissions reductions potential - such as cement and concrete, mining and metals, oil and gas (including biofuels), transport and manufacturing - are yet to be activated towards a brown-to-green (BtG) transition. When such industry sectors start to align with a 2-degree emissions trajectory, new green financing opportunities could be created for assets and projects with ambitious climate targets and an increased focus on low carbon production modes.

The Climate Bonds Initiative has been active in promoting a BtG transition strategy in GHG-emissions intensive industries around the world.

BtG reflects the fact that, in the short- to medium-term, large companies in many sectors will inevitably straddle both brown and green assets, progressively reducing exposure to brown assets and practices as they increase capex towards, and adoption of, greener modes of operation.

It also embodies a recognition that, both globally and locally, the expectation of institutional investors is that progress towards low or zero-carbon business models, is increasingly indicative of corporate performance, hedging of climate risks and long-term value accretion.²¹

If progress on lowering sector emissions continues to be minimal, for Australia to reach its current Paris targets (or the coming ratchet to 1.5°C degrees), faster progress will be required from all major sectors of the economy.

In the resources sector, Rio has divested its coal assets,²² while Glencore has restricted new coal investment. BHP has announced a new program of emissions reduction across Scope 1, 2 and, significantly for a high-carbon exporting nation, Scope 3 emissions.²³ It has also flagged a zero-carbon by 2050 ambition.²⁴

A BtG strategy will require 'brown' organisations to commit to strategic change, undertaking tangible and verifiably climate-relevant measures that relate to companies' core business activities. They will need to progress from broad statements of strategy or intent to disclosure of climate risk as envisioned by compliance with the TCFD and, ultimately, to a visible reflection of climate-friendly investment on balance sheets, in capex plans and borrowing programmes.

Credible green bonds are a highly visible means to support this transition from brown into green. Even a small initial share of green capital expenditure could be a credible indicator of more to come, if it is combined with a re-orientation and acknowledgment to investors that achieving low carbon targets and then zero-carbon operating models are inevitable business destinations between now and 2050.

Notwithstanding statements from financial regulators, many ASX-listed companies are yet to give climate risks and opportunities due weight, let alone develop low carbon or net zero-carbon business models.²⁵ One option to reverse this lack of urgency would be a BtG transition strategy developed through long-term engagement projects with major institutional shareholders.

The emerging concentration of ownership between Australia's superannuation sector and ASX companies may provide an additional joint incentive for a series of such structural engagements.



Renewable energy

Energy generation, transmission or storage technology that has low or zero carbon emissions. This can include solar energy, wind energy, bioenergy, hydropower, geothermal energy, marine energy or any other renewable energy source.

Sector overview

In 2018, 21% of Australia's energy was supplied by renewable energy resources.

While this lags behind other OECD member countries, the percentage is up from 17% in 2017 with South Australia (53%) and Tasmania (95%) leading the way.

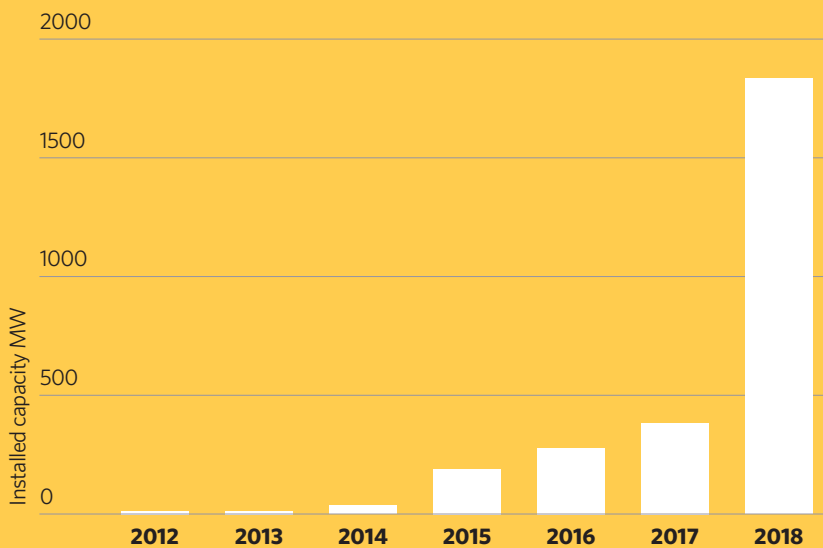
2018 was a record-breaking year with investment in large-scale renewable energy projects – mainly wind and solar – doubling from AUD10bn in 2017 to AUD20bn in 2018.²⁶ By year end, 14.5 GW of new generation was under construction or financially committed. This is equivalent to four times the energy output of the much-debated Liddell Power Station (one of Australia's oldest and largest coal-fired power plants).²⁷

Rising power prices are spurring investment in small-scale renewable energy both by businesses and homeowners. Commercial solar installations have grown 45% and residential by 43%.²⁸

Investment by large oil and gas companies in renewable energy development is an emerging trend and an important part of the brown to green transition. This includes Shell (Delga Solar Farm), BP (Lightsource) and Total (Total Eren).

The corporate PPA market is growing with 20 contracts signed in 2018, accounting for a total of 932MW. Corporates are attracted to improving price certainty within a volatile market. The corporate PPA market is still in its early stages and while promising, can involve high transaction costs for project developers in finding and negotiating with buyers. Notwithstanding the slight uptick in corporate PPAs, offtake issues continue to temper enthusiasm in the sector with an overall slow-down in PPAs.

Cumulative installed large-scale solar capacity



Source: Clean Energy Council³²

The Australian and New Zealand sustainable finance market is accelerating with the emergence of loans in both green and sustainability-linked formats. This follows the growth of green bonds over the last three to four years.

The Australian market has developed in line with global best practice, showing diversity of product, transparency for investors and lenders, innovation in the use of proceeds and commitment to uphold market standards

Christina Tonkin, Managing Director, Loans & Specialised Finance, ANZ

State governments are playing a strong supportive role providing some certainty in the absence of a national climate and energy policy.

State-led action to support grid stability and clean energy integration includes system strategies and related roadmaps.

State government investment is also supporting renewable energy project trials, making solar more accessible for all households and supporting the roll out of large-scale battery storage

States with clean energy and/or 2050 emissions targets include:³¹

NT: 50% renewable energy by 2030

SA: Net zero emissions by 2050

VIC: 50% clean energy by 2030, Net zero emissions by 2050

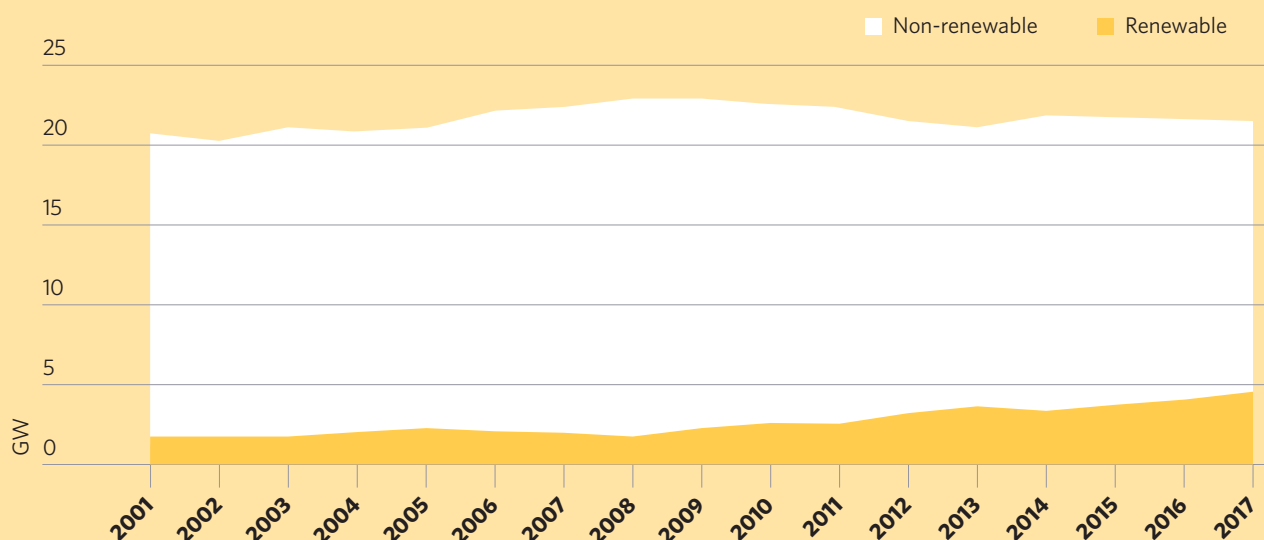
TAS: Net zero emissions by 2050

QLD: 50% clean energy by 2030

NSW: Net zero emissions by 2050,

ACT: 100% clean energy by 2020, Net zero emissions by 2040,

Renewable energy generation is on the rise while non-renewable generation remains flat



Source: Department of Environment and Energy²³

Renewables are also a jobs story with the sector employing over 13,000 people. In 2018 alone, over 10,000 jobs were created in renewable energy facilities' construction. This is underplayed in the political narrative but it is a strong positive for the industry and one that may help to drive the transition to a low carbon economy.

However, issues with the grid and changes to marginal loss factor calculations have dampened the outlook, particularly for remote projects in Northern Queensland, Northern Victoria and Southern New South Wales.

The lack of replacement policies for the National Energy Guarantee (NEG) and Renewable Energy Target (RET) has resulted in continued policy uncertainty and there are concerns that the industry may lose the recent momentum it has built. The NEG was officially abandoned in late 2018 despite broad industry support. The RET has been a major driver behind the growth in renewables over the past few years, but ends in 2020.

We expect solar and wind energy generation to continue to have the greatest potential for investment. While growth will continue into 2020, the negative drivers noted will likely result in muted growth compared to the dizzying heights of 2018.

Battery storage and pumped hydro projects will be the likely winners of the increasing focus on storage. Large storage projects have made headline news, including the much-discussed Snowy 2.0 (a 2018 report case study) which will add 2,000 megawatts of energy generation and provide 175 hours of storage for the National Electricity Market.²⁹

Other storage projects include the 24-month PowerBank trial in Western Australia, which went live in November 2018. The project connects a 105kW Tesla battery to the electricity grid, allowing participating households with rooftop solar panels to virtually store up to 8kWh of excess power generated during the day from their solar photovoltaic (PV) systems in the battery.³⁰

The Australian Renewable Energy Agency (ARENA) has announced up to AUD40 million in funding towards the deployment of a pumped hydro energy storage (PHES) project in South Australia.

Meanwhile, Tasmania is making a bid to use its hydro resources to become the Battery of the Nation, providing flexible, dispatchable energy in the state and on the mainland. HydroTasmania has short-listed 14 high potential pumped hydro sites with a combined storage capacity of 4.8 GW.

Investment pathways

Renewable energy project developers and asset owners in Australia have access to a wide variety of funding options from banks, specialised project financiers, debt clubs, investment funds, direct investors and the capital markets.

Green bonds are best suited to large projects or portfolios of assets and can be structured in a number of ways, including ABS, use of proceeds bonds, and project bonds. Aggregation of smaller projects such as rooftop solar loans or leases can be done through green securitisation (e.g. FlexiGroup green bond) or through banks originating green loans and refinancing in the green bond market (e.g. ANZ, CBA, NAB and Westpac). Renewable energy funds are also being used to support greenfield renewable energy projects and stimulate innovation.

Publicly-backed funding support for renewable energy projects can be accessed through **ARENA, Clean Energy Finance Corp** and **Clean Energy Innovation Fund**. There are also private sector funds like the Powering Australian Renewables Fund, which is an AUD2-3bn fund created by AGL to develop and own approximately 1,000 MW of large-scale renewable energy power generation projects.

Darlington Point Solar Farm

Proponent: Octopus Investments and Edify Energy

Location: Murrumbidgee, New South Wales

Status: Under construction, with power generation expected at the end of 2020

Classification: Solar, Generation facilities

Description: The Darlington Point Solar Farm is a 333 MW DC single-axis tracking project and currently the largest farm under construction in Australia, on 1,993 acres of former grazing land adjacent to TransGrid's Darlington Point substation.

Output: The project will produce 333 MW of renewable energy, initially through a recently awarded PPA of 150 MW.³⁵

Cost: \$450m

Financial structure: The project is co-owned by Edify Energy and Octopus Investments (the UK's largest solar investor) with two Australian banks jointly providing debt. A PPA has been entered into with Delta Energy.



Source: Edify Energy³⁵

Asian Renewable Energy Hub

Proponent: CWP Renewables

Location: Pilbara, Western Australia

Status: Planned with financial decision expected in 2022 and first generation in 2025/6.

Classification: Solar and wind generation facilities

Description: The project is proposing to deliver 15 GW of wind and solar to power local industry and international customers. The anticipated renewables split will be 2/3 wind and 1/3 solar. The project will generate very large volumes of cheap, clean renewable energy, which is ideal for the large-scale production of green hydrogen for markets both in Australia and overseas.

It has recently signed a land use agreement with indigenous landowners, making it the first project of this type to be built exclusively on native title. Proponents are in current negotiations with the Western Australian Government to support necessary grid upgrades. Recently, project proponents have announced a new focus on upscaling green hydrogen and derivative products.



Source: Asian Renewable Energy Hub, 2019³⁶

Output: Solar, wind, hydrogen generation facilities, up to 3,000 construction jobs and 400 maintenance jobs

Cost: AUD22-30bn

Financial structure: Development capital will be provided by Macquarie Group and other partners.³⁷

Update on 2018 featured case studies

Kidston Solar Project

Stage 1: Complete, Genex reported the first revenue in December 2018. It is ramping up to producing 145GWh of electricity per year.

Stage 2: In April 2018 environmental approvals were secured for the pumped hydro project. In July 2019 an AUD610m federal concessional loan was approved.³⁴

Snowy 2.0

Feb 2019: Planning permission given for exploratory works. Early works are now underway.

EIS for Main Works expected to be submitted in late 2019 with commencement of main works to begin in 2020.

April 2019: Salini Impregilo awarded the AUD5.1bn contract for the civil works and electromechanical component of the project.

SA-NSW Interconnector

July 2018: Project assessment complete, preferred option identified as a 330kV connector running from Robertson (SA) to Wagga Wagga (NSW) via Buronga.

Feb 2019: Project assessment conclusions report published.

July 2019: South Australian Government grants project with Major Project Status.



Low carbon transport

Transportation modes and ancillary infrastructure that produce low or zero direct carbon emissions. This can include national and urban passenger rail and freight rail networks; Bus Rapid Transit (BRT) systems; electric vehicles; and, bicycle transport systems. It does not include the building of road networks.

Capital mobilisation for low carbon transport continues to target the use of energy-efficient transportation and the development of projects that reduce carbon emissions.

Sector overview

The transport sector accounts for 18% of Australia's GHG emissions, up 22% in absolute terms from 2005.³⁹ Without significant changes to the transport and energy system in Australia, emissions from transport are projected to be over 80% higher by 2030 than in 1990.⁴⁰ Changing this emissions trajectory will require a massive increase in public transport and rail systems, stronger vehicle emissions standards and increased EV take-up.

Public transport and freight rail networks are already seeing some increases in investment - the primary drivers are population growth (with resultant increase in consumer demand), increased urbanisation and worsening congestion in major cities. This is reflected in the emphasis on transport in ANZIP's list of projects across Australia. By value, over 75% of the projects listed on ANZIP relate to transport, over 50% of which could be considered low carbon transport projects (mostly rail projects).

Large rail projects are being developed across the country with the largest including Sydney Metro (case study right), Melbourne metro and Brisbane metro. These large multi-billion-dollar projects have a number of expansion stages under construction, in planning or proposed (Melbourne Suburban Rail Loop and Melbourne Airport Rail). The drivers behind urban rail expansion remain clear and we expect such projects to dominate infrastructure spending for years to come.

Electric vehicles (EVs) have also received increasing attention over the past year with sales reaching new highs, albeit from a very low base in comparison with other developed countries. Australia's EV market share is 0.1% compared to China (2.2%), New Zealand (1.1%) and Sweden (6.3%).⁴¹ One EV opportunity was identified in the pipeline - the Queensland Electric Super Highway

Australian cities have lower populations and longer commute times compared to global peers



Source: Department of Infrastructure and Regional Development⁴³

which is the main large-scale infrastructure network proposed by government. This currently has 17 charging stations with a proposal to expand by adding 50 new stations. There is also an opportunity for the growth of private charging networks. Some private providers have received government subsidies in Europe and the US.

Investment pathways

A variety of funding structures are available to encourage private sector involvement in the long-term financing required including green bonds, outright asset acquisitions, public private partnerships (PPP) and the securitisation of green assets.

In addition to public funding, the private sector has a strong pipeline of transport projects including PPPs, operating franchises and rolling stock leases.⁴²

A key principle in the **Australian Infrastructure Plan** is that more diverse sources of funding are required to deliver infrastructure priorities. This includes value capture where the recommendation is that, "all governments should routinely consider land value capture in public infrastructure investments". This model is used in Hong Kong but not widely in Australia.

From 2019/2020, the government has stated that it will invest AUD13bn in transport infrastructure through innovative financing options, which include concessional loans, guarantees, phased grants and availability payments, equity injections and value capture. Government-backed concessional loans are a new structure which provides greater leverage against the revenue streams of transport (i.e. fares).

As private sector appetite increases, funding sources will continue to diversify, and investment will accelerate. Investors seeking exposure to low carbon transport projects and assets have a range of investment pathways to consider.

Government-owned low carbon transport assets are often identified in their green bond offerings. This pathway provides indirect exposure for investors to specific projects and provides attractive credit and liquidity credentials for institutional investors.

More direct investment pathways include participation in consortium debt arrangements and/or equity stakes in individual projects via PPPs or other public-private ownership and financing structures.

More and more investors are talking to us about climate resilience and how NAB can support the capacity of the financial sector to better support investments in climate resilient and green infrastructure. The 2019 GIIO report is an essential tool for our industry because it provides a snapshot of the many projects that governments, policy makers and investors can direct capital towards.

David Jenkins, Head of Sustainable Finance, Corporate & Institutional Banking, National Australia Bank

Sydney Metro

Proponent: NSW Government

Location: Sydney

Status: Part complete, part under construction, to be fully operational by 2025.

Classification: Public Passenger Transport, Rail, Infrastructure

Description: Sydney Metro is Australia's largest public transport project and is split into four sections.

- Northwest was opened on 26 May 2019.
- The City and Southwest: Planning approval was received in 2017, and construction has begun. Services are expected to start in 2024.
- West project will connect the City to Parramatta doubling rail capacity between the 2 areas. Construction is expected in 2020.
- The Greater West project will be a rail link to Western Sydney Airport and the planned Badgerys Creek Aerotropolis. Construction is due to commence in 2021 with completion in 2026 along with the airport.

Output: 31 metro stations and more than 66 kilometres of new metro rail, in Sydney, over four stages.



Source: ANZIP

Cost:

- Northwest: AUD8.3bn
- City and South West: AUD11.5 to AUD12.5bn
- West: AUD10bn
- Greater West: AUD15-AUD20bn

Financial structure: A range of financing structures have been used, including State government funding with traditional procurement and PPPs. Not all financing structures are confirmed.⁴⁴

Geelong Fast Rail

Proponent: Australian Government with funding match from Victorian Government

Location: Geelong Region, specifically Sunshine to Wyndham Vale

Status: Planned

Classification: Public Passenger Transport, Rail, Infrastructure

Description: The project will include the construction of new electrified track pairs, track and signalling upgrades and new station platforms. Investigations are also being carried out to determine how it can integrate with the planned Melbourne Airport Rail Link. A Geelong Fast Rail Reference Group has been established, chaired by MP Christine Couzens (seat of Geelong).

Output: New rail tracks, stations, including a new super hub at Sunshine to facilitate better integration of rail services. This will increase the capacity of current services, in line with regional population growth forecasts, while decreasing commuting times.



Source: ABC 2018

Cost: An initial AUD2bn (Federal Government), with an anticipated funding match from the Victorian Government.

Financial structure: Funding from Federal Government and Victorian Government, plus PPP arrangements.⁴⁵

Update on 2018 featured case studies

Canberra Light Rail - Stage 1

Operations for Stage 1 commenced in April 2019. The final cost of Stage 1 was AUD675m

Melbourne Metro Rail

Work is underway to build 9 kms of rail tunnels that will service 5 new underground stations. Construction is estimated to be 12 months ahead of scheduled completion (2025). The cost estimate is expected to be 165% of the original budget.

Brisbane Metro

Early works including intersection upgrades have commenced. Council is working to prepare for construction by relocating some public utility services.

Inland Rail

The Inland Rail Programme Business Case is now completed, with formal planning approvals in process for 5 projects in NSW and QLD. Offices are now established in Sydney, Melbourne, Brisbane and Toowoomba.



Sustainable water management

Assets that do not increase greenhouse gas emissions or that aim at emission reductions over the operational lifetime of the asset, address adaptation, and increase the resilience of surrounding environments. This covers built as well as nature-based water infrastructure.

Water management projects could include water capture and collection, water storage, water treatment (with methane emissions treatment), flood defence, drought defence, stormwater management, and ecological restoration/management.

Sector overview

Climate change has already led to significant changes in rainfall distribution and water availability across Australia. Bureau of Meteorology data shows that April–October rainfall is decreasing across South West Australia with a 20% decrease in May–July rainfall in the same region. This has been accompanied by a long-term increase in extreme fire weather and a longer fire season across large parts of Australia.⁴⁶

The regulation of water assets varies between the jurisdictions as does the urgency to upgrade and replace aging infrastructure and respond to the needs of a growing population and the challenge of climate change.

Enhanced planning processes and increased upfront investment will be required for water infrastructure to meet the dual challenges of climate change and rapid urbanisation particularly as Australia's major cities are forecast to need 73% more than the current water supply by 2050.⁴⁷

The drought across Eastern states has continued to dominate the headlines in 2019 and is a major driver in infrastructure discussions and planning for the sector. In NSW, the Sydney Desalination Plant, much debated over the past decade given its inactivity was, in January 2019, restarted after a seven-year hiatus.⁴⁸ The increasing severity and frequency of droughts means that it, and other desalination projects around the country, may soon be expanded. Sydney's was built to allow for a doubling of capacity. It can provide 15% of the city's water needs, while in Perth, 50% can already be provided through desalination.

Better water recycling is being looked to as a cheaper and more efficient alternative to increasing water supply than desalination. The primary barriers are cost and perceptions. Recycled water is not used for drinking water supply in Australia, but there are opportunities and initiatives to increase its use in industrial, agricultural and other applications. In Sydney, the Central Park Recycled Water Scheme was the largest recycled water scheme in the world when it was launched in 2014. The scheme collects wastewater from residential, commercial and retail precinct buildings, treats it and distributes it within the precinct to supply water for cooling towers, irrigation, toilet flushing and washing machines.⁴⁹

Other initiatives include Australia's first Groundwater Replenishment Scheme that re-injects recycled water into climate-independent groundwater aquifers for later use, in line with global best practice (see case study below).

Meanwhile, the demand for water from industrial applications and agricultural supply chains also continues to grow, impacting aquifer recharge and surface water flows. Downstream license holders relying on variable offtakes remain highly exposed, bolstering calls for a new national water plan in 2020 to spur technological innovation through PPP arrangements underwritten by the National Water Infrastructure (NWI) Development Fund and NWI Loan Facility.⁵⁰

Westpac recognises the transition to a net zero emissions economy cannot be achieved without the active support of major financial system actors. Banks, insurance companies and superannuation funds all have a vital role in ensuring investment flows towards the green infrastructure that will help reach this goal. Accelerating green finance, including green bonds, green loans and green underwriting is increasingly the market mechanism to support this transition

Lyn Cobley, Chief Executive, Westpac Institutional Bank

Investment pathways

Most water assets in Australia are publicly-owned, and this is unlikely to change in the medium-term. The urban and rural water corporations are owned by the State Government and funded by the respective State treasuries.

Similar to the investment pathways for low carbon transport, the primary investment pathway for sustainable water infrastructure is using taxpayer funds through government budgets. Thus, for green bonds in this sector, the main opportunity is for green bonds to be issued by State Governments.

A few privately-operated initiatives do exist – these include the Central Park Recycled Water Scheme, operated by a private utility. Investment in the construction, ownership and refinancing of new types of infrastructure such as water desalination assets, commercial and industrial water infrastructure may provide further options for investors.

The Australian Water Association (AWA) has undertaken research showing there are a range of alternative financing options available for water infrastructure projects from a variety of investment sources. These include green bonds, PPPs, value capture, long-term leases and Regulated Asset Base Model (RAB).⁵¹ The RAB model is where publicly-owned entities and/or private companies own, invest in and operate infrastructure assets. In exchange for the delivery of services, an economic regulator will agree to 'fund' the costs of the infrastructure through the provision of regulated revenue. This is particularly relevant for industries where there is a high risk of monopoly pricing (e.g. water supply).

Groundwater replenishment scheme

Proponent: Water Corporation

Location: Craigie, Western Australia

Status: Under construction

Classification: Water, Nature-based solutions

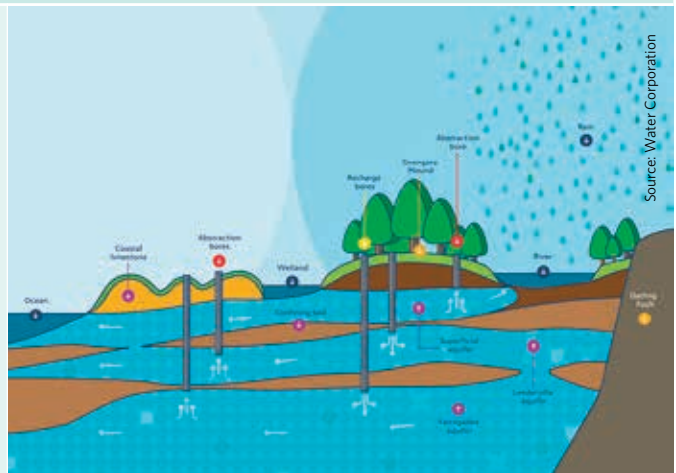
Description: This is the first full Groundwater Replenishment Scheme of its kind in Australia. It will provide a new climate-independent water source to boost potable supplies in Perth by pumping 28bn litres of water into aquifers for reuse. Stage 2 of the Scheme has recently commenced, involving constructing a second Advance Water Recycling Plant at the Beenyup facility, drilling four new bores for discharge and monitoring and a new 13km pipeline.

The pipeline will be finished in mid-2019, with full construction complete in late 2019 before testing and commissioning.

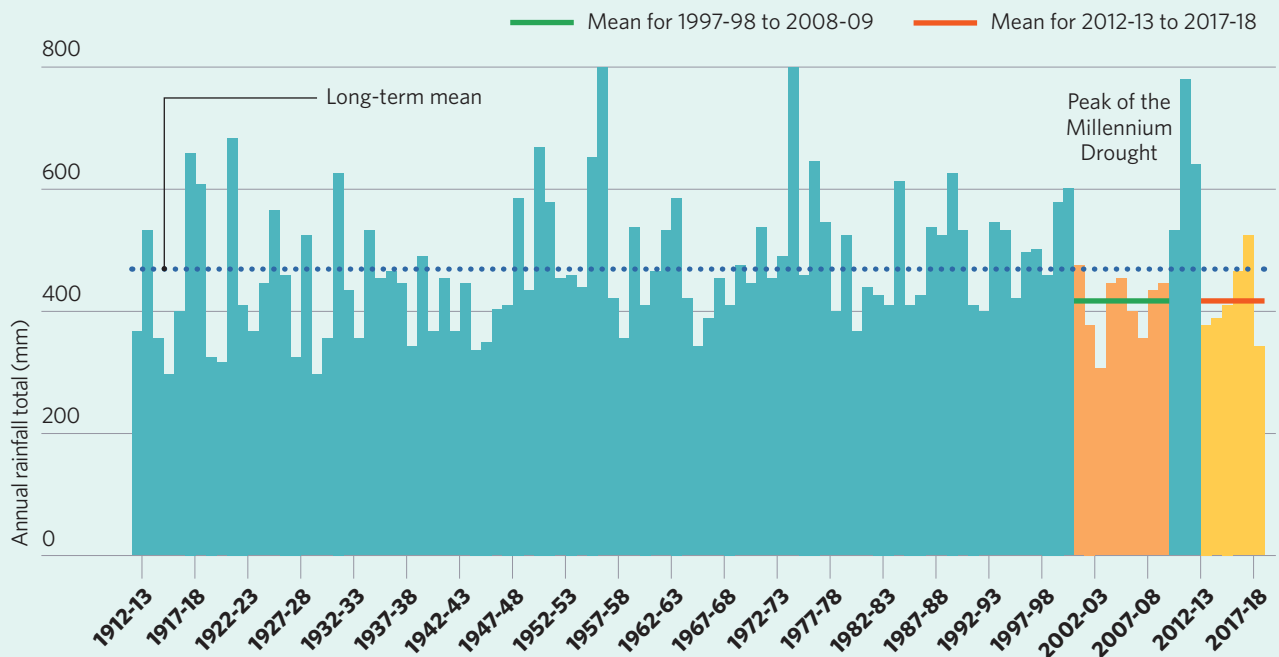
Output: The project will pump 28 billion litres of potable water into Perth aquifers for use when needed.

Cost: AUD262m

Financial structure: Government plus PPP arrangements⁵²



Annual rainfall totals in the Murray-Darling Basin, July 1911 to June 2018



Source: Bureau of Meteorology

Update on 2018 featured case studies

Shoalhaven Reclaimed Water Management

REMS 1B Scheme has commenced construction, with completion expected in 2019.

Wyaralong Water Treatment

Stage 3: Remains in planning stages, with completion date estimated to be in late 2022.



Sustainable waste management

The efficient use of resources to cut down on waste production, coupled with collection and disposal systems that promote reuse and recycle, thereby minimising residual waste going into energy from waste (EfW) facilities. Where waste must go to landfill, there are gas capture systems installed to minimise emissions as well as measures to minimise run-off and other negative impacts on surrounding environments

Sector overview

Globally, the waste sector has the potential to contribute a 10-15% reduction in global GHG emissions. Opportunities in prevention, reuse, recycling, and energy recovery can achieve significant mitigation by reducing landfill emissions, reducing emissions linked to resource extraction and production using virgin materials, and providing an alternative energy source that substitutes fossil fuels.

In Australia, waste is responsible for approximately 2% of GHG emissions. Waste recovery was increased to 57% in 2018 (20% in 2007) and the average waste production per capita has decreased 10% since 2007. However, overall waste generation continues to increase as the population grows.⁵³

The pipeline review revealed few waste projects that met the minimum project size requirement (AUD50m). This is a feature of the sector, particularly in recycling where small projects dominate. The exception to this is EfW projects (also referred to as Waste-to-Energy). The 10 largest recycling projects identified are listed in the pipeline even though they did not meet the size hurdle.

Prevention projects in particular were difficult to identify. While prevention is desirable, it is challenging to convert into fundable infrastructure projects. Prevention is arguably not part of the waste sector itself but cuts across all sectors (much like energy efficiency) which will require a different model to address.

The industry faces numerous challenges ahead- posed by population growth, lack of investment and, more immediately, import bans. China's ban on the importation of many recyclable materials in 2018 has resulted in materials being stockpiled and saw thousands of tonnes of recyclables sent to landfill.⁵⁴

While the ban has spurred much debate and some political momentum, the complexity of negotiations between states and the federal government have hampered attempts to resolve the problem. In August 2019, the federal government committed AUD20m to grow Australia's recycling industry.

This is a strong signal and comes on top of state commitments including AUD47m by NSW and AUD13m by Victoria.

The 2019 Australian Infrastructure Audit notes that waste management is poorly planned with generation increasing but infrastructure declining. It highlights a lack of mature markets for private investment in recycling and waste disposal.

The National Waste Policy, originally put forward in 2009 and updated in late 2018, provides a national framework for waste and resource recovery in Australia and outlines roles and responsibilities for collective action by businesses, governments, communities and individuals. The 2018 update focuses on waste avoidance, improved material recovery and use of recovered material. A key proposal is a common approach across states.⁵⁵

Policy certainty is vital, as investment in large facilities for EfW or plastics recycling is expensive and therefore not possible without regulatory certainty. One issue is the lack of standardisation of recycling regulations and standards across states and territories.

We are committed to playing our role in limiting climate change and supporting Australia's transition to a low-carbon economy, but we can only do this by working closely with our customers, communities and industry partners. The Green Infrastructure Investment Opportunities (GIIO) report will help us pursue our goals, by outlining the projects that will make a direct contribution to international climate targets and long-term environmental sustainability

Andrew Hinchliff - Group Executive, Institutional Banking and Markets, Commonwealth Bank of Australia.

A common theme in the industry is re-envisioning waste as a resource where recycled materials produce jobs and revenue streams. If policy and waste streams are more certain, there may be greater impetus to invest in EfW or plastics recycling plants.

A number EfW facilities are in various stages of development and procurement across Australia. These include the two case studies as well as the Australian Paper Project, East Rockingham Project and Ballarat Waste to Energy Project.

New Climate Bonds Criteria covering waste management has been open for public consultation and is now undergoing final review. The criteria is scheduled for publication in Q4 2019. EfW projects have been the source of much debate around the world. Climate Bonds Initiative views them as necessary transition assets to deal with residual waste. Specific criteria for EfW are under discussion.⁵⁶

Investment pathways

Most of the major waste management assets and projects in Australia are publicly owned, with public financing used primarily for waste treatment facilities, waste to energy processing and sanitary refill infrastructure.

Waste treatment facilities usually demand significant capital. Currently, the majority of funding comes from State government budgets. The primary green bond opportunity is through green bonds issued by State governments.

Environmental levies have also been used historically to finance waste treatment projects. In July 2019, Queensland's waste levy commenced for 39 out of 77 local government areas. The levy aims to reduce waste going to landfill and provides funding for better waste recovery practices.⁵⁷

There are also new facilities proposed for development via PPPs. Investment pathways include participation in consortium debt arrangements and/or equity stakes in individual projects via PPPs or other public-private ownership and financing structures.

Privately owned asset and projects, which include recycling facilities and some waste to energy facilities, also offer other means of debt and equity investment.

Kwinana Thermal Waste to Energy

Proponent: Macquarie Capital, Phoenix Energy and Dutch Infrastructure Fund

Location: Kwinana, Western Australia

Status: Under construction

Classification: Waste, Energy from Waste

Description: The project will develop a waste processing facility that will use moving grate technology to process approximately 400,000 tonnes of municipal solid waste, commercial and industrial waste and/or pre-sorted construction and demolition waste per annum, to produce approximately 36 MW of baseload power for export to the grid.

Output: 36 MW of baseload power. This will be among the first utility scale waste to energy facilities constructed in Australia, diverting approximately 25% of Perth's post recycling rubbish (400,00 tonnes) from landfill sites.

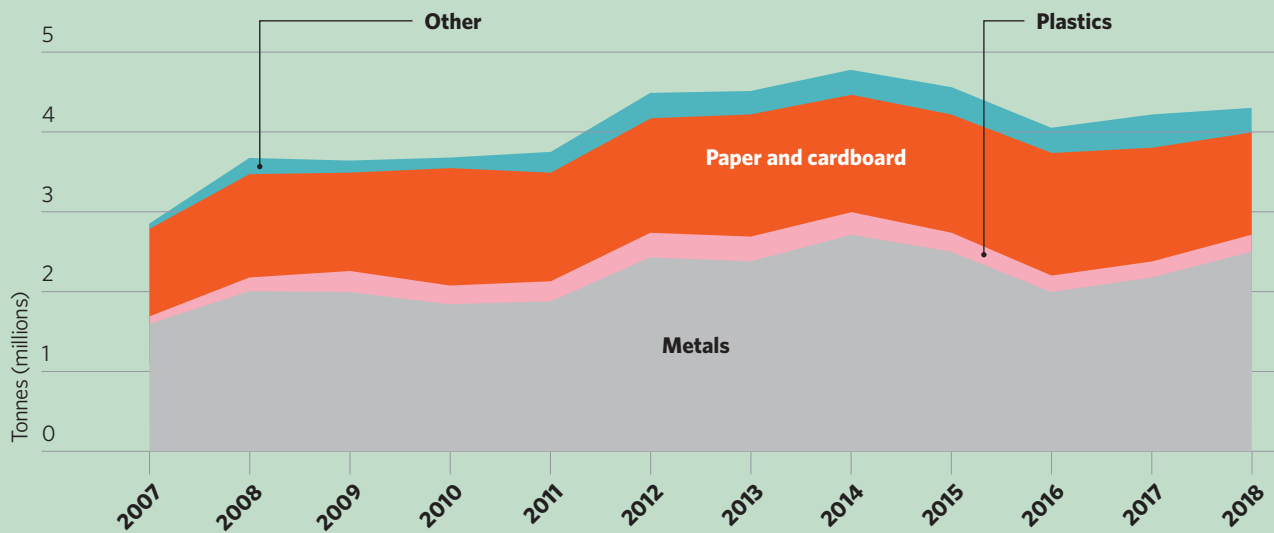
Cost: AUD696m

Financial structure: Private investment, co-developed by Macquarie Capital and Phoenix Energy Australia, with co-investment by the Dutch Infrastructure Fund and funds from CEFC.⁵⁸



Source: Acciona

Exports of waste materials for recycling by category from Australia to all destinations 2007-18



Source: Department of Environment and Energy⁵⁹

Swanbank Thermal Waste to Energy

Proponent: REMONDIS

Location: Southeast Queensland

Status: Planned, construction expected in 2020

Classification: Waste, Energy from Waste

Description: A Green Energy and Recycling Park in southeast Queensland to generate up to 50 MW of baseload electricity and around 200 construction and 50 operations jobs. REMONDIS operates more than 50 WtE projects in Europe, and also owns landfill sites. The Queensland Government is currently assessing the project proposal. Approval will secure progress towards a pipeline of similar projects. The construction period is estimated at four to five years.

Output: 50 MW baseload power generated via conversion of between 300,000 and 500,000 tonnes of waste per year, diverting approximately 25% of Perth's post recycling rubbish (400,00 tonnes) from landfill sites.

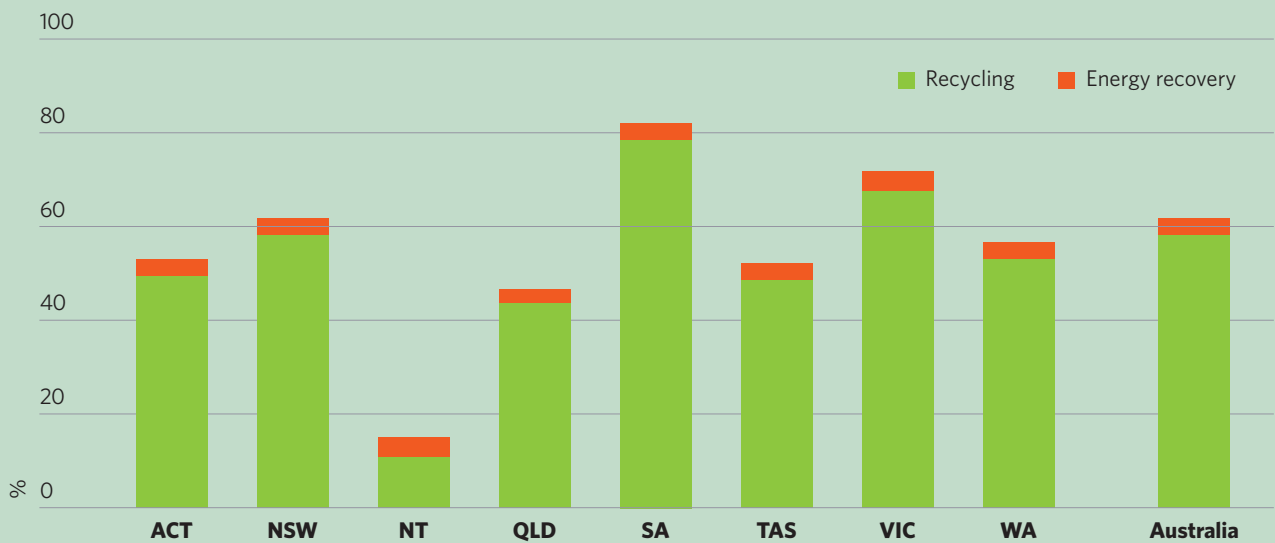
Cost: AUD400m⁶¹

Financial structure: TBA



Source: Remondis

Resource recovery and recycling rates of core waste by jurisdiction, 2016-17



Source: Department of Environment and Energy⁶⁰

Green buildings

Commercial and residential buildings, new or upgraded, operating with low carbon emissions. Credentials and emissions performance are demonstrated through an accepted rating or 'green' assessment process.

Sector overview

Globally, the greening of buildings has the largest potential to significantly reduce GHG emissions compared to other major emitting sectors.⁶²

In Australia net zero goals are becoming mainstream in property. Building industry superannuation fund Cbus has committed to net zero emissions by 2030 across its listed and unlisted property portfolio⁶³ while Investa Office Management is pursuing a net zero emissions target by 2040.⁶⁴

Green building certification programmes are now institutionalised. As at July 2019 there are 2429 Green Star-rated projects up from 1986 in 2018.

Green Star rated buildings in Australia have been shown to produce 62% less GHG emissions than the domestic building average buildings and consume 51% less potable water than if they had been built to meet minimum industry requirements.⁶⁵

The 2018 GRESB Real Estate results also showed that Australian real estate sectors are leading the world in sustainability performance. While the global average GRESB score was 68 points, Australia and New Zealand achieved an average GRESB Score of 76 (73 in 2017). This compares to 70 for North America and 66 for Europe.⁶⁶

In early 2019, Energy Ministers released the Trajectory for Low Energy Buildings, a national plan that sets a trajectory towards zero energy (and carbon) ready buildings for Australia.⁶⁷ The Trajectory outlines opportunities for the building sector while proposing to strengthen energy efficiency provisions in the National Construction Code (NCC) for residential and commercial buildings from 2022. It also considers options for improving existing buildings.

Investment pathways

Low carbon residential and commercial buildings in Australia are attractive to private-sector investors. Consequently, the vast majority of the capital required for construction, ownership and refinancing of green buildings is provided by the private sector without government support.

The private sector uses a wide variety of equity, debt and project finance structures for green building development, including funds, green loans and green bonds. Government-owned green buildings have also been financed with sub-sovereign green bond.

Australia has the foundations to expand green infrastructure provision throughout the 2020s and beyond.

Few nations enjoy this confluence of positive circumstances: a robust banking sector with green finance expertise, a superannuation sector with proven infrastructure capability and willingness to explore new investment models.

One Melbourne Quarter

Proponent: Lendlease

Location: Victoria

Status: Completed in 2019 (first building)

Two Melbourne Quarter is currently under construction

Classification: Low carbon buildings, Commercial

Description: One Melbourne Quarter is the first building which will be part of a 2.5 hectare precinct development.

One Melbourne Quarter achieved 6-Star Green Star certification in April 2019 while Two Melbourne Quarter has been registered for certification.

Output: A 12 story 6-Star Green Star commercial building in Melbourne. It is the first building in a planned precinct development.⁶⁸

Cost: One Melbourne - AUD175m

Two Melbourne (25 storey, yet to be completed) was sold to Australian Prime Property Fund and First State Super for AUD550m.⁶⁹

Precinct cost estimated to be > AUD2bn⁷⁰



Source: Melbourne Quarter⁷¹

Financial structure: Capital model used was 'fund through' - a funding model structured through a forward sale to a capital partner resulting in staged payments prior to building completion.

The precinct is owned by the Lendlease-managed Australian Prime Property Fund Commercial.

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Sponsors



ANZ is a leading sustainable financing bank in Asia Pacific, assisting customers in their transition to a low carbon economy. Recent highlights include co-financing French renewable energy developer Total Eren's Kiamal Solar Farm, the largest Solar PV plant in Victoria. ANZ led market leading loans in both green and sustainability linked formats for Brookfield and Sydney Airport. The bank also led Woolworth's green bond, a first for an Australian supermarket retailer and elsewhere as well as social bonds for Australia's National Housing Financing and Investment Corporation and Housing New Zealand Corporation. The bank has achieved A\$14.6bn of a A\$15bn October 2020 five-year target to fund low carbon and sustainable projects including renewable energy, green buildings and low carbon transport. ANZ is also a participant in the Australian Sustainable Finance Initiative and the New Zealand Sustainable Finance Forum to establish roadmaps for realigning the finance sector.



Established 160 years ago, **NAB** today serves 9 million customers in Australia, New Zealand, and around the world, including in our key trading and investment markets of Asia, UK and USA. Our goal is to make a positive and lasting impact on the lives of our customers, people, shareholders, communities, and our environment. We recognise that climate change is a significant risk and a major challenge for the global economy, and for society. As a global provider of financial products and services, we seek to play a key role in financing the transition to a low carbon economy, and to innovate across all of our key sectors and markets to support low carbon opportunities for our customers. In 2017, NAB committed to increasing environmental financing for customers from AUD18bn by 2022 to AUD55bn by 2025. NAB has been at the forefront of the green, social, and sustainability bond markets in Australia since 2011, recognised as both a 'Green Bond Pioneer' and 'Australian Sustainability Debt House of the Year'.



Westpac is Australia's first bank and oldest company. We have a long history of sustainability leadership, having been recognised in the Dow Jones Sustainability Indices (DJSI) for 17 years in a row. We have committed to source the equivalent of 100 per cent of global electricity consumption through renewable sources by 2025. Part of this will be achieved through a power purchase agreement with Bomen Solar Farm, to be built in Wagga Wagga NSW by mid-2020. Westpac has a lending target of AUD25bn to climate change solutions by 2030 with more than AUD10.1bn lent as at 1Q19. Through our support for a low carbon economy we have become Australia's largest financier in the renewable energy sector, with renewables representing over 71% of our lending to the electricity generation sector. Westpac has played a role in developing the AUD green bond market facilitating its opening with the World Bank's first issuance in 2014 and become the first New Zealand bank to raise funding through a green bond in 2H19.



At **Commonwealth Bank of Australia**, we recognise our role in supporting long-term investment in low carbon and renewable infrastructure and how we can help accelerate the growth of climate bonds in Australia. In FY17 we arranged AUD 1.02 billion of climate bonds. These included Australia's first green asset-backed securitisation and the world's first climate bond from a tertiary education institution.

We led more than AUD 2 billion of green and sustainability notes in FY18 and a further AUD 1.8 billion in FY19 for clients around the globe. Our Energy Efficient Equipment Finance program continues to help businesses fund energy efficient vehicles, equipment and projects. As at 30 June 2019 our lending exposure to the renewable energy sector was AUD 3.6 billion.

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Climate Bonds Taxonomy

The Climate Bonds Taxonomy identifies the assets and projects needed to deliver a low carbon economy and gives GHG emissions screening criteria consistent with the 2-degree global warming target set by the COP 21 Paris Agreement. More information is available at <https://standard.climatebonds.net/taxonomy>.



ENERGY	TRANSPORT	WATER	BUILDINGS	LAND USE & MARINE RESOURCES	INDUSTRY	WASTE	ICT
Solar	Private transport	Water monitoring	Residential	Agriculture	Cement production	Preparation	Broadband networks
Wind	Public passenger transport	Water storage	Commercial	Commercial Forestry	Steel, iron & aluminium production	Reuse	Telecommuting software and service
Geothermal	Freight rail	Water treatment	Products & systems for efficiency	Ecosystem conservation & restoration	Glass production	Recycling	Data hubs
Bioenergy	Aviation	Water distribution	Urban development	Fisheries & aquaculture	Chemical production	Biological treatment	Power management
Hydropower	Water-borne	Flood defence		Supply chain management	Fuel production	Waste to energy	
Marine Renewables		Nature-based solutions				Landfill	
Transmission & distribution						Radioactive waste management	
Storage							
Nuclear							

Certification Criteria approved
 Criteria under development
 Due to commence

Climate Bonds INITIATIVE

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