HSBC Global Research

5 May 2021

Downunder Digest

Australia's vast low-carbon climate opportunities

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Multi-Asset - Australia

- Australia's role as a large exporter of energy products, including coal and liquefied natural gas, is well understood …
- … but the country also has vast opportunities as a renewable energy exporter, including embodied in processed metals
- Global carbon tariffs and the falling cost of renewables technology could re-shape Australia's comparative advantage

Paul Bloxham
Chief Economist, Australia, New Zealand & Global Commodities
HSBC Bank Australia Limited

Jamie Culling
Economist, Australia, New Zealand & Global Commodities
HSBC Bank Australia Limited

Wai-Shin Chan, CFA
Head, Climate Change Centre; Head, ESG Research
The Hongkong and Shanghai Banking Corporation Limited

Sunny thinking

Australia has had a volatile climate change policy history – including the implementation of a carbon tax in 2012 and its removal in 2014. However, as the economics changes and other countries take clearer action, local policy is shifting too. All of Australia's state and territories are committed to 'net zero' carbon emissions by 2050 and the Federal government is making some moves towards it, supported by a large number of agencies and direct measures.

Of course, the best way to reduce carbon emissions is a carbon price-guided system, but, in its absence, the collective action of governments and corporates, in effect, creates a 'shadow' carbon price.

We see two key economic opportunities for Australia.

First, investing in the transition of Australia's energy and transport network by shifting it further towards renewables. This is helped by the falling price of solar and wind technologies, which is making such investments increasingly economically viable. Australia has made progress, but there is a long way to go, with 21% of Australia's electricity produced using renewables (in 2019, up from 8% in 2008). The electrification of Australia's transport network is less advanced – with electric cars accounting for only 0.2% of all motor vehicles on the road.

Second, Australia's natural advantages, such as a large land mass, lots of empty space, sunlight and wind. As a result, the country could develop a comparative advantage in low-carbon energy production for export.

These exports could be direct via cable (there is a project already doing this to connect power to Singapore) or through conversion to hydrogen. Australia could also use low-carbon energy to process minerals, such as steel and aluminium, thus embodying the low-carbon energy in products. The economic viability of these minerals processing opportunities would be strengthened by shifts to global tariffs on the carbon intensity of products (such as it being proposed by the EU and the US at present), re-shaping Australia's comparative advantage in this regard.

This is an abridged version of a report by the same title published on 5-May-21. Please contact your HSBC representative or email AskResearch@hsbc.com for more information.

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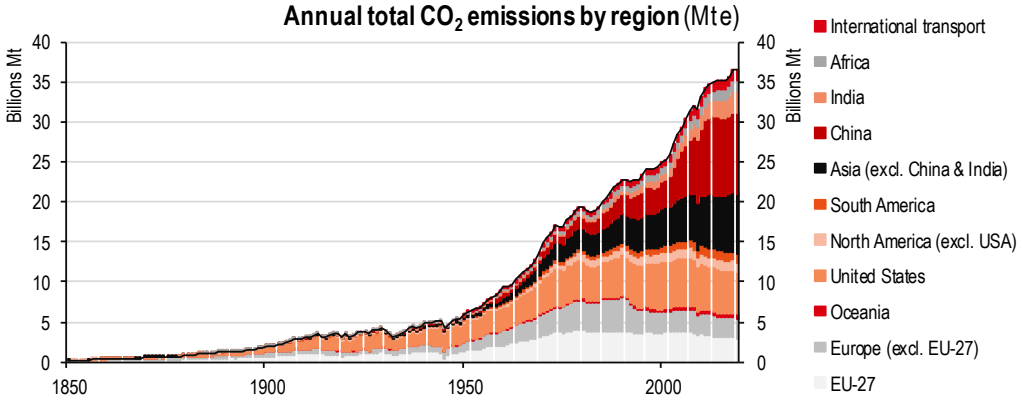
1. Australia is a relatively small contributor of emissions, reflecting its small population



Source: Our World in Data, HSBC

Australia's emissions challenges …

From a global perspective, Australia is hardly a leader in carbon emission abatement or policy.

Australia is a significant fossil fuel exporter …

To start with, Australia is a large exporter of fossil fuels. Australia is the world's largest exporter of coking coal and the second largest exporter of thermal coal, both products that contribute significantly to global carbon emissions when used. Australia is also the world's largest exporter of liquefied natural gas (LNG) and the 27th largest exporter of oil.

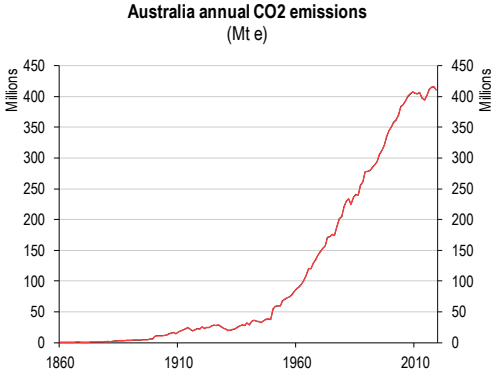
Emissions are, of course, usually attributed to the location where the fuels are consumed, and so these exports are not typically counted in Australia's emissions statistics.

… and had comparatively high emissions on a per-capita basis

Nonetheless, while Australia accounts for only a low share of global emissions (most of 'Oceania' in Chart 1) due to a small population, Australia is a larger emitter than most countries in per-capita terms. At just over 20Mt CO_2e per person in 2018 (Chart 3), Australia ranks around 11th in the world for per-capita emissions, emitting more per person than the US and China, respectively. A handful of countries, such as Qatar and the UAE, emit more per capita. Of the G20, Australia stands out as the highest per-capita emitter – and without 'net zero' alignment.

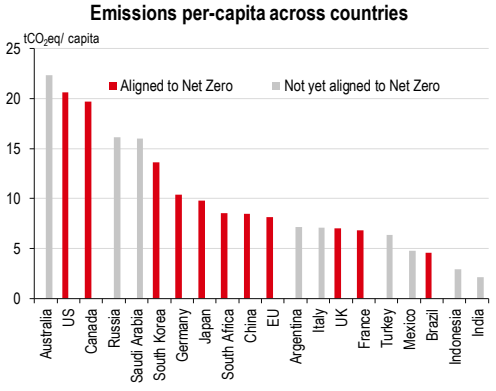
In HSBC's 'economic carbon intensity and fossil fuel dependence metric', Australia ranks 33rd amongst 77 countries covered.

2. Australia's annual emissions have levelled off from 2010 …



Source: Our World in Data, HSBC

3. … but remain high on a per-capita basis relative to the rest of the world



Source: PRIMAP, World Bank, HSBC. Note: 2018 values.

Locally, energy production is still quite carbon-intensive, in part due to the ready availability of coal. The large land mass and associated longer distances make an electric vehicle roll-out more challenging than elsewhere. A large agricultural industry produces emissions and a by-product from Australia's resources industry is 'fugitive' emissions, which are released during extraction, processing and delivery of fossil fuels.

The politics of climate change policy has been complicated and volatile

The politics of climate change policy has also been complicated and volatile in Australia. Over the past decade this has included the introduction of a carbon tax in 2012 and its repeal in 2014. Despite a consensus from economists that a carbon price-based system is the most efficient way to facilitate climate policy, the politics of implementing a national carbon price-based system has been fraught. Instead, Federal policymakers have shifted to a range of direct subsidy measures to support and encourage investment in renewables.

State and territory governments have moved more quickly than Federal policymakers. All of them committed to 'net zero' emissions by 2050, and a number of them are running carbon credit schemes, as well as significant direct measures to support investment in renewables. However, without leadership from the Federal government, there is a risk of inconsistent policies developing across Australia.

… and its vast opportunities

As we have described above, Australia has a challenging starting point. As Chart 4 also shows, Australia needs additional action to meet its 2030 Nationally Determined Contribution (NDC) target, and, even if the decarbonisation rate were to jump significantly, this would still leave the country well above the trajectory needed to align to a 'net zero' emissions pathway by 2050.

The challenging starting point means vast opportunities

However, this challenging starting point, from an emissions perspective, means that Australia also has vast opportunities.

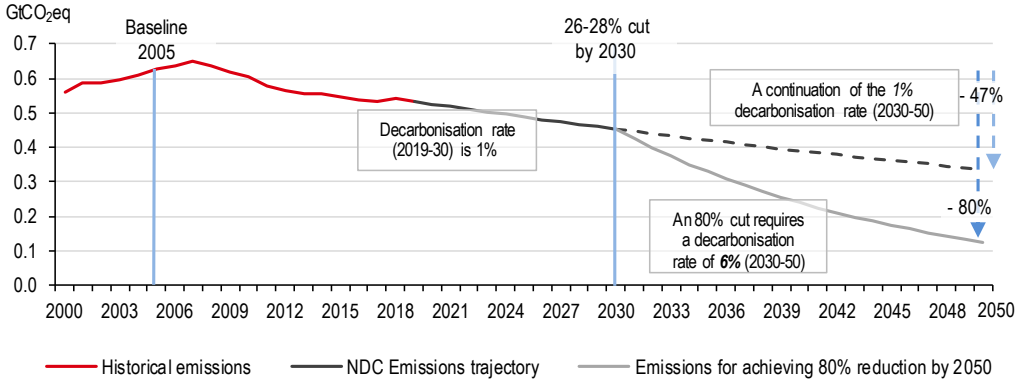
These are driven by a number of factors.

First, the economics of renewables have dramatically shifted in recent years due to the sharp fall in the cost of renewables, particularly due to the plummeting prices of solar panels, wind technologies and batteries for energy storage.

Second, Australia has natural advantages such as a large land mass, lots of empty space, sunlight and wind, further lowering the cost of using these technologies to produce energy.

Third, global policy moves are further improving the economics of renewables. Large global investment funds are shunning investment in fossil fuel projects, effectively increasingly the

4. Australia has a challenging starting point for achieving 'net zero' by 2050



Source: Department of Industry, Science, Energy and Resources, HSBC estimates
Note: Assumes an 80% decline in 2050 (from 2005) levels as a base case, in the absence of a formal pledge.

availability of funds for investment in renewables. Governments are also taking significant steps to support reduced global emissions.

Finally, politics in Australia is also moving along. Recent announcements by the Federal government suggest a boost for spending on "clean" energy projects in the upcoming May 2021 Budget. The Australian government will also take a Long-term Emissions Reduction Strategy to the 26th United Nations Framework Convention on Climate Change (UNFCCC) climate summit in Glasgow, Scotland, in late 2021.

The local emissions picture

The single largest source of Australia's emissions is from electricity production, which is still dominated by coal-fired power stations, and accounts for around one-third of overall emissions (Chart 5).

Electricity production is the largest single source of emissions

Other sources of emissions in Australia include transport, which accounts for nearly one-fifth of the total, agriculture at 13%, and a full 10% of Australia's emissions are released during the extraction and processing of fossil fuels.

Improvement in land use in recent years has led to land use becoming a 'carbon sink', netting out 3% of total emissions in 2020. Changes to land management, increases in the area of land under forest, reductions in primary forest clearing, the fostering of vegetation growth, and the use of shelter belts have all contributed.

Electricity generation and the rise of renewables

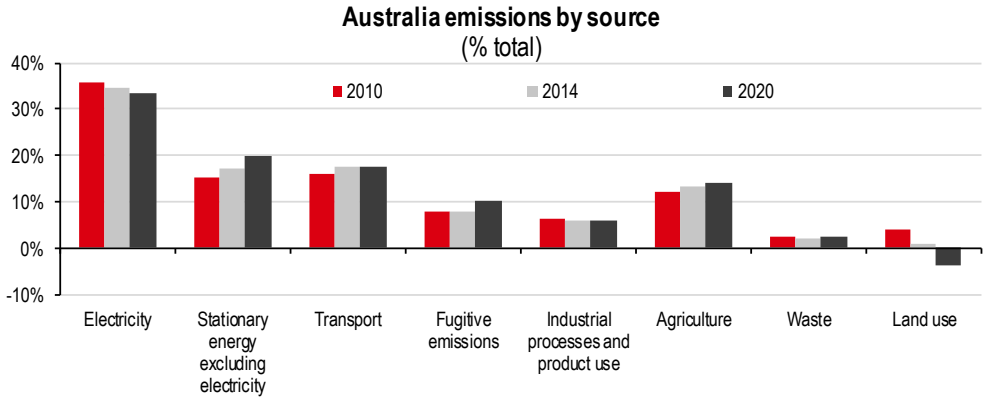
The recent story for Australia for electricity production has been quite positive (Chart 5). Although it is still the case that, as of 2019, 80.3% of Australia's electricity was produced using fossil fuels (58.5% using coal from 24 coal-fired power stations), it is also the case that a majority of all new electricity generation capacity since 2018 has been solar or wind (Chart 6).

… but there is progress being made in shifting to renewables

Electricity emissions have been falling, driven by large amounts of renewable generation entering the National Electricity Market (NEM) (Chart 7). The NEM is one of the largest interconnected electricity systems in the world, supplying nine million customers, accounting for 82% of Australia's total electricity emissions.

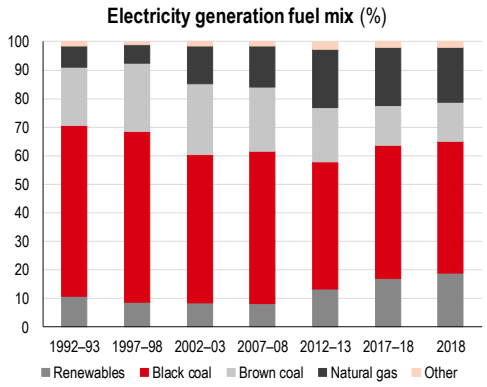
Around 20% of total electricity generation is now done by renewables. Rooftop solar is the largest contributor to renewables growth, followed by wind, with hydro's contribution falling significantly in recent years. As a recent essay by Australia's former Chief Scientist, Alan Finkel, points out, around 30% of suitable dwellings have solar panels in Australia, which is the highest

5. Electricity produces the bulk of emissions, but other sources are trickier to remedy



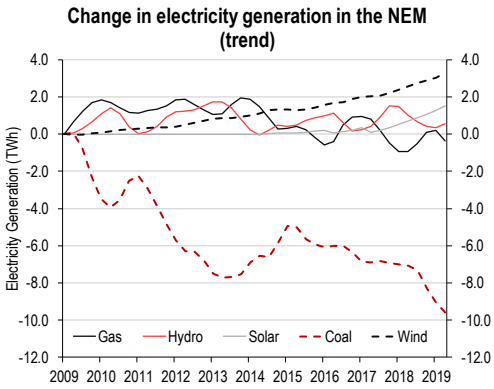
Source: Department of Industry, Science, Energy and Resources, HSBC

6. Renewables a rising share of electricity



Source: Department of Industry, Science, Energy and Resources, HSBC

7. Coal in the NEM has declined



Source: Department of Industry, Science, Energy and Resources, HSBC

in the world (Finkel 2021). He also notes that at the end of 2019, solar capacity was the highest in the world on a per-capita basis, at 644 watts per person, ahead of Germany at 589 watts per person and Japan at 500 watts per person.

The falling cost of renewables should further motivate greater investment in renewable electricity capacity

Technological innovation and falling manufacturing and installation costs have contributed to the attractiveness to invest in renewables. One way to quantify the trade-off between renewables and traditional electricity generation is the Levelised Cost of Electricity (LCOE). The LCOE represents the present value of the cost of building and operating a power plant over its assumed life. The LCOE is estimated to be between 40% to 60% of the cost of a new fossil fuel plant, falling significantly over the past decade, despite a higher up-front fixed cost.

The Federal government had set the Renewable Energy Target (RET) to ensure that at least 33,000 gigawatt-hours (GWh) of Australia's electricity comes from renewable sources by 2020. That target was met in September 2019. A Small-scale Renewable Energy Scheme (SRES) also provides incentives for households and businesses to install small-scale renewable energy systems.

Australian states have been leading in incentivising renewable energy investment (Table 8).

As Finkel (2021) discusses in detail a key challenge for renewables is the need to also invest in storage capacity – be it batteries or hydro – given the inconsistency of solar and wind generation.

8. Australia state and territory key renewable energy initiatives

State/Territory	Policies
New South Wales	Energy Infrastructure Roadmap to deliver 12 GW of new transmission capacity, increasing NSW's renewable energy penetration to over **60% by 2030**
Queensland	AUD145 million for three new renewable energy corridors; AUD500 million Renewable Energy Fund for renewable energy projects; **50% by 2030** renewable energy target
Victoria	Second renewable energy auction to procure 600 MW of new solar and wind energy; AUD540 million to establish six renewable energy zones; Solar Homes programme for landlords and renters; **50% by 2030** renewable energy target
South Australia	**100% by 2030** renewable energy target; 500% of the state's electricity demand by 2050; three renewable hydrogen export hubs featuring electrolysers of up to 2.6 GW; AUD3 billion wind and solar project
Western Australia	Renewables expected to account for **70% by 2040**; 100 MW/200 MWh battery planned, the first on WA's main grid; AUD22 million investment to bring forward renewable hydrogen targets to 2030
Tasmania	**200% by 2040** renewable energy target; Renewable Hydrogen Action Plan to make Tasmania a significant global producer and exporter of renewable hydrogen by 2030; Battery of the Nation names first pumped hydro site
Australian Capital Territory	Pledge to install a 250 MW battery network; **'net zero' emissions by 2045**; phasing out all gas use by 2045
Northern Territory	**50% by 2030** renewable energy target; MW battery to support the Darwin-Katherine grid; AUD6000 grants available through the Household and Business Battery Scheme

Source: Clean Energy Council, HSBC

However, even with the cost of storage accounted for, the economics of renewables stack up relative to coal-generated power. As the RBA points out in a recent Bulletin article, solar generation with six hours of pumped hydro storage costs around AUD100 a mega-watt hour, while new black coal-fired electricity generation costs AUD150 a mega-watt hour and more than AUD200 a mega-watt hour with carbon capture and storage (de Atholia T., Flanigan, G. and Lai, S., 2020).

In short, the improving economics of renewables as well as policy moves have already seen emissions from electricity production fall in recent years and further falls are expected in coming years, particularly as a number of coal-fired power stations are scheduled to be closed.

Transport and the road to an electric transition

The move to EVs in Australia is slow …

The story for transport has been less positive than electricity, with transport emissions increasing since 2010. Despite the economic and environmental benefits, Australia's progress has been lacklustre when it comes to transitioning to electric vehicles (EVs). A lack of charging infrastructure, battery lifespan, higher up-front costs, and insufficient incentives have all weighed on the transition. Australia is also one of a few developed countries without a consistent national approach to EV adoption.

The opportunities here are clear. There is a consensus on the need for governments and industry to collaborate for the adoption of EVs. A number of ideas have been proposed along these lines, including: a national target for electric vehicle uptake, clear fuel standards for cars, investment in infrastructure, national awareness campaigning, as well as financial and non-financial incentives.

… creating opportunities for speeding this transition along

One further positive for transport emissions comes from the COVID-19 shock. Over 2020, the impact of COVID-19 led to large reductions in transport activity, which resulted in transport emissions declining. However, transport emissions are closely related to trade and population growth – we expect all to increase as Australia's borders (gradually) open and trade continues.

Fugitives and agricultural challenges

Two more challenging areas for Australia with regard to emissions are 'fugitive' and agriculture emissions.

Fugitive emissions (usually methane) are released during the extraction, processing and transport of fossil fuels, while agriculture emissions emerge from biological processes associated with agricultural commodity production.

Fugitive emissions are a challenge …

Fugitives emissions are largely driven by the amount of coal produced, the emissions intensity of the mine and the amount of methane captured. There are over 100 operating coal mines in Australia, and the 10 largest emitting mines account for 54% of coal fugitive emissions. Largely reflecting strong demand for higher quality coal from Asia, the Office of the Australian Chief Economist and the International Energy Agency project Australia's coal production to increase to 2030.

Keep in mind, Australia is a producer of high-quality coal, which produces less pollutants than lower grade materials. In short, if coal users, mostly in Asian economies, shifted to using lower grade coal from elsewhere, this would add to, not reduce, global carbon emissions. All in all, however, the export basket could still hardly be described as 'green'.

In 2020, Japan, China and South Korea took receipt of 66 per cent of Australia's coal exports. In October 2020, these countries announced long-term emission reduction targets to align to net zero by mid-century. In the short term, this is unlikely to have any impact on fugitive emissions; however, it could dampen coal (export) demand, and fugitive emissions longer term.

… as are emissions from agriculture

Agriculture emissions are mainly driven by beef cattle, followed by sheep and dairy cattle. Agricultural outputs have a strong dependence on short-term climate variations, with Australia emerging from a two-year drought, agriculture emissions could rise as farmers rebuild herds. Continued high agriculture commodity prices also provide incentives to increase herds.

The majority of beef will likely continue to be fed by grazing on pasture, and livestock numbers are increasing, meaning continued emissions from enteric fermentation. An increase in crop production is also likely to increasing fertiliser emissions. On this, Australian scientists are also working on solutions that use an extract from seaweed (*Asparagopsis*) as a supplement in cattle feed, which reduces the amount of methane they produce by 90%.

Reducing fugitive or agricultural emissions would be particularly helped by a carbon price-based system, to more rapidly motivate moves to lower these emissions. An alternative is regulatory intervention. Either of these pathways could open up opportunities for greater sequestration of carbon emissions into biomass, such as forests, pastures, soils and woodlands, of which Australia has in ample supply, given its large land mass.

Australia's many agencies and mechanisms

The optimal economic system for dealing with the emissions challenge is to have an explicit price for carbon. However, Australia's political history has been fraught in this area.

Australia does not have a carbon price-based system for emission reduction …

In the early 2000s, there was much discussion by policymakers about the possibility of implementing an emissions trading scheme, but one was not implemented. Instead, Australian policymakers opted for a carbon tax, implemented in 2012. However, a change of government in 2014 saw the carbon tax removed, despite research showing that the tax had cut emissions. Climate change policy at the Federal level shifted to focusing on direct subsidy measures.

Of course, as economists understand well, in the absence of an explicit carbon price, there is a 'shadow' carbon price that forms. That is, as the market seeks to find a way to allocated investment to reducing emissions, there is an implicit price that is being assumed for carbon emissions. This 'shadow' price then helps to better understand the potential impact of pollution on the profitability of a project, a new business model, or an investment, also providing insight into often hidden risks. For comparison, the 'shadow' price in the US is USD51 tCO_2, and set to rise even further.

… instead it relies on a range of direct measures and agencies

In the absence of an explicit carbon price, emissions trading scheme, or carbon tax, a large range of other policies has formed. At the Federal level, Australia has the Renewable Energy Target, the Australian Renewable Energy Agency (ARENA), the Clean Energy Finance Corporation and the Emissions Reduction Fund (Table 9).

Despite slower progress, policy volatility and some regressions at the Federal level, there has been a more consistent move towards 'net zero' initiatives at the state and local levels of government. This has been reinforced, not just by a pressing need to take action to reduce emissions to deal with climate change *per se*, but because of the rapidly shifting economics of investing in renewables. All of the states and territories have had 'net zero' targets for 2050.

9. Federal climate-related policies and agencies

Policy	Detail
Renewable Energy Target	At least 33,000 gigawatt-hours (GWh) of Australia's electricity comes from renewable sources by 2020; the **Large-scale Renewable Energy Target (LRET)** requires high-energy users to acquire a fixed proportion of their electricity from renewable sources; the **Small-scale Renewable Energy Scheme (SRES)** provides a financial incentive for individuals and businesses to install small-scale renewable energy systems
Australian Renewable Energy Agency (ARENA)	Established by the Australian government on 1 July 2012 to improve the competitiveness of renewable energy technologies and increase the supply of renewable energy through innovation that benefits Australian consumers and businesses
Clean Energy Finance Corporation	An Australian Government-owned Green Bank that was established to facilitate increased flows of finance into the clean energy sector, responsible for investing AUD10 billion in clean energy projects on behalf of the Australian Government
Emissions Reduction Fund	The Emissions Reduction Fund is a voluntary scheme that aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions

Source: Department of Industry, Science, Energy and Resources, HSBC

A low-carbon energy export opportunity

Despite the challenges, there are also significant potential economic opportunities for Australia in exporting renewable energy directly and embodied in processed materials, such as steel and aluminium. Keep in mind, 7-9% of global emissions come from converting iron ore into steel. Of course, at the same time, the global transition to 'net zero' emissions is expected to see long-term demand for Australia's fossil fuel exports fall, particularly of coal.

Exporting renewable energy, directly or embodied in processed minerals …

The new opportunities have been highlighted prominently by Australian economist, Ross Garnaut (2019), in his recent book, Superpower. As he notes there is already a 'strong commercial case' for building new primary iron-making capacity using natural gas near Western Australian iron ore mines using natural gas and increasing the use of renewable hydrogen over time (Garnaut 2019, p119). It is also worth keeping in mind that, although Australia's iron ore and coking coal mines are located on opposite sides of the continent, renewable energy resources are located near the metal mines. A similar opportunity exists for aluminium, given that Australia is the world's largest producer of alumina and bauxite and that the process of converting these materials into aluminium is highly electricity-intensive.

There is also an economic case for directly exporting energy, either via undersea cables (for example, to Singapore or Indonesia) or stored in the form of hydrogen ore ammonia. A direct cable project, Sun Cable, is already underway to build the world's largest solar energy infrastructure through the Australia-ASEAN Power Link (AAPL). Its aim is to use sunlight from the Northern Territory to supply around 20% of Singapore's total electricity needs from 2027.

As the Australia government's 'Hydrogen for Australia's future' points out, both Japan and Korea are set to be large and expanding markets for exported hydrogen (Australian government, 2018). It notes that Japan is aiming for an import target by 2030 of 300,000 tonnes of hydrogen and a long-term target of 10 million tonnes. Korea is looking to import 170,000 tonnes of hydrogen by 2030 and 500,000 tonnes by 2040. Producing 10.5 million tonnes of hydrogen would be the energy equivalent of about 25 million tonnes of liquefied natural gas, which is about one-third of Australia's current LNG exports. This would require around 700 terawatt-hours, which is around 2-3 times Australia's total electricity generation at present.

… is expected to present significant opportunities for Australia

Importantly, these export opportunities will become more profitable as policymakers in other large economies seek to achieve 'net zero' emissions targets and corporates also prioritise environmental issues. This will create export opportunities for Australia.

As Professor Garnaut suggests 'Australia should have a much stronger comparative advantage in energy-intensive minerals and agricultural processing in a zero-emissions world economy than it had in the fossil-fuel past' (Garnaut 2019, p10).

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