



MAPPING AUSTRALIA'S NET ZERO INVESTMENT POTENTIAL

SUMMARY

A critical mass of countries are transforming their economies in the move towards net zero emissions. Currently over 50 per cent of Australia's two-way trade is covered by countries with targets to achieve net zero emissions by around mid-century. This is expected to grow as more countries commit to net zero emissions targets and other emissions mitigation actions in advance of the Glasgow Climate Summit at the end of 2021 (COP26).

In response to the COVID-19 pandemic, some of the world's largest economies are also positioning their recovery packages to be socially and environmentally sustainable, unlocking additional investment opportunities in future-facing assets and companies.

To date, there has been significant analysis of the employment and economic opportunities associated with a transition to net zero emissions in Australia but there has been no quantification of the economy-wide investment opportunities. This is a surprising gap in our understanding of climate risks and opportunities, given the significant role investors play in making every part of the economic transformation possible.

To begin to fill this gap, IGCC commissioned Energetics to quantify the value of investment needed in each sector and asset class under an orderly transition to net zero emissions in Australia ("orderly transition"), compared with a business-as-usual scenario ("hothouse").

Key findings

- 1. Boosting the economic recovery in the short term:** An orderly transition to net zero emissions would unlock around \$63 billion in total investment to 2025. Over the next five years emissions abatement in the manufacturing sector (\$15 billion), transport infrastructure such as charging stations for light and heavy vehicles (\$6 billion), and green hydrogen production (\$3 billion) are the biggest investment opportunities in the energy and industrial sectors. Carbon sequestration also emerges as its own major investment asset class as all sectors invest in nature-based solutions to achieve their net zero emissions targets and other medium-term goals (\$33 billion).
- 2. Mapping the multi-billion dollar investment opportunity in the medium term:** Investment in renewable and clean electricity production through the period 2020 to 2050 is the sector that will emerge as the largest investment opportunity over all (\$385 billion). After 2030, commercial scale opportunities in green hydrogen production hit scale, leading to substantial investment

About Us

The Investor Group on Climate Change (IGCC) is a collaboration of Australian and New Zealand investors focused on the impact that climate change has on the financial value of investments. IGCC represents institutional investors with total funds under management of over \$2 trillion, and others in the investment community interested in the impact of climate change. IGCC members cover over 7.5 million people in Australia and New Zealand.

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in this emerging industry. By 2050, green hydrogen is the second largest investment opportunity at nearly \$350 billion. The next largest opportunities to 2050 are transport infrastructure (\$104 billion), carbon sequestration (\$102 billion), and electricity transmission and distribution (\$98 billion).

- 3. Little upside in business as usual:** Total investment in the economy falls significantly under the hothouse scenario compared to the orderly transition scenario. By 2025, lost investment opportunities relative to an orderly transition total -\$43 billion and are most prevalent in carbon sequestration (-\$18 billion), in the manufacturing sector (-\$14.7 billion) and in transport infrastructure (-\$5.3 billion). By 2050, lost investment opportunities are around -\$265 billion compared to a scenario with clear long-term policies and market signals supporting net zero emissions in place.

Note that this analysis does not seek to capture all potential investment within Australia over the time period. Instead it covers key investment opportunities by sector in the domestic transition to net zero emissions. The potential for investment in net zero export opportunities, such as green hydrogen, is thus not included, and so the total potential investments in the transition is expected to be significantly larger.

Investors, companies and governments will need to work together to achieve a resilient net zero emissions economy by 2050. This is particularly the case as governments will be more fiscally challenged after deploying immediate COVID-19 relief. Mobilising private capital will therefore be critical to recovery and unlocking net zero investment opportunities. Action will be needed across a range of fronts:

- **Policy:** Governments and financial regulators delivering durable long-term climate, finance and energy policy.
- **Engagement:** Collaboration between investors and companies on delivering net zero emissions strategies.
- **Disclosure:** Organisations providing effective, investible climate-related financial disclosures.
- **Investment:** Businesses and investors shifting investment practices.

This analysis points to the sheer scale of the investment opportunity associated with an orderly transition to net zero emissions by 2050. The billions of dollars identified in the short and long term would support the jobs, livelihoods and wealth of millions of Australians. Many of these prospects are in regional Australia with multi-billion opportunities in carbon farming, renewable energy and energy and transport infrastructure, and advanced manufacturing. These are opportunities Australia cannot afford to ignore.



INTRODUCTION

A critical mass of countries are transforming their economies in the move towards net zero emissions, while new technologies and net zero investment opportunities are emerging at scale (Table 1).

Table 1: A net zero emission economy is the destination for a growing number of Australia's major trading partners. Overview of progress towards 2030 targets and net zero commitments by G20 countries.²

	Top ten major trading partners (% trade)	AUD Sustainable Recovery (% of total fiscal stimulus spending)	On track to meet 2025/30 target	Mid century net zero target
Australia		\$3.7bn (1.1%)	N	N
Top Trading partners in G20				
China	1st (24.4%)	\$12.38bn (0.7%)	Y	Y
EU	2nd (13.3%)	>\$400bn (30%)	Y	Y
France		~\$54.4bn (6.6%)		
Germany		~\$50.34bn (3.6%)		
Italy		\$1.25bn (<0.1%)		
Japan	3rd (9.7%)	\$0bn	Y	N ("early as possible" in 2nd half of the century)
USA	4th (8.8%)	<\$1bn (<0.1%)	N	N (Yes, under Biden)
Republic of Korea	5th (6.5%)	~\$37bn (5%)	N	Y
India	6th (3.6%)	\$0bn	Y	N
UK	8th (3.5%)	~\$43bn (7.3%)	Y	Y
Other selected G20 and major trading partners				
Canada		\$4bn (2.8%)	N	Y
Brazil		\$0.4bn (0.2%)	N	N
Indonesia		\$0.3bn (0.2%)	Y	N
Singapore	9th (3.5%)	\$0bn	Y	N (in 2nd half of the century)
New Zealand	7th (3.5%)	No data	Y	Y (all gases ex. farm methane)



In response to the COVID-19 pandemic, some of the world's largest economies are also positioning their recovery packages to be socially and environmentally sustainable, unlocking additional investment opportunities in future-facing assets and companies. For example, fiscal packages to respond to the COVID-19 pandemic in the European Union (EU) and South Korea have seen investment in hydrogen jump from less than \$1 billion last year to over \$19 billion as these nations seek to control and dominate future clean energy markets.³

Notably, the recent economic and social impacts of the COVID-19 pandemic have not reduced investor appetite to manage climate change and invest in solutions. IGCC's recent investor survey found that over 70 per cent of investors have signalled that the pandemic has had no impact on progressing climate change investments or developing climate-aligned solutions.⁴

Tapping into these investment opportunities across a range of asset classes at scale will be one of the defining investment trends of the 21st Century and will be key to determining the future prosperity of countries, companies and communities.

HOW REAL IS THIS OPPORTUNITY FOR AUSTRALIA?

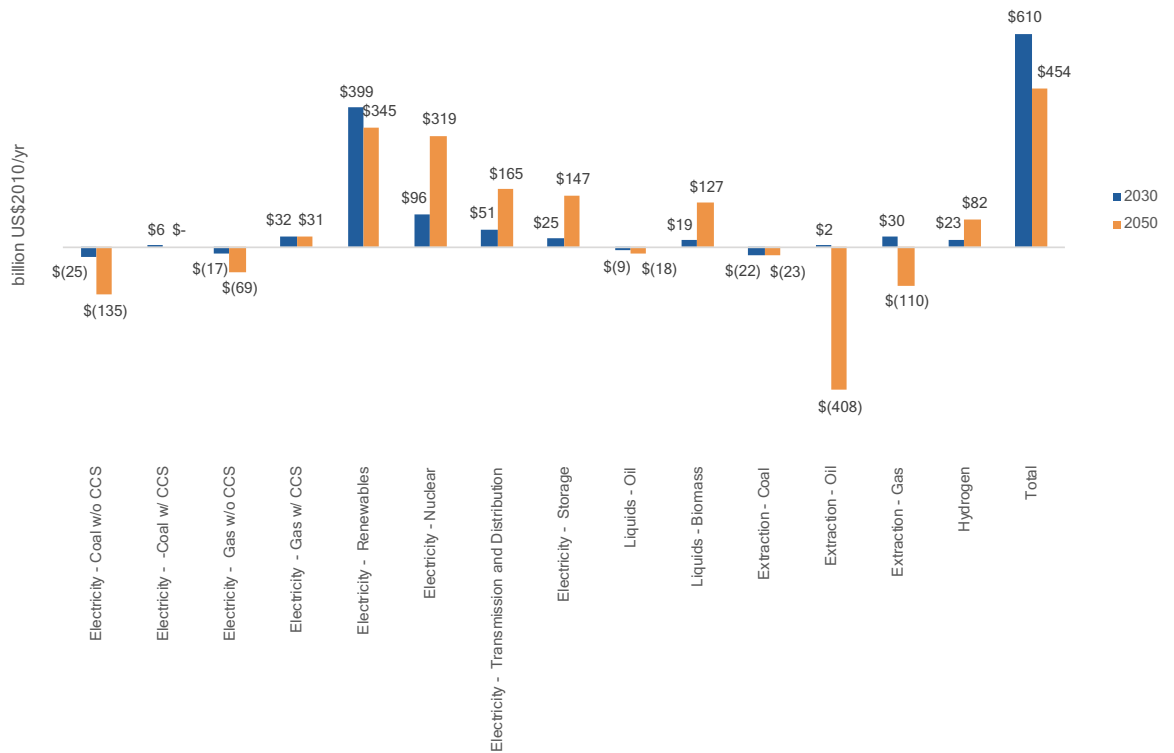
There has been significant analysis of the employment and economic opportunities associated with a transition to net zero emissions in Australia.⁵ Despite this there has been no quantification of the net zero-aligned, economy-wide investment opportunities. As the investment sector makes transformation across all others possible, quantification of institutional investment opportunities in achieving net zero emissions is a surprising gap in our understanding of climate risks and opportunities.

There is also limited global data available. Recent transition scenarios produced by a global coalition of central banks (NGFS scenarios),⁶ are a useful starting point to help investors and other stakeholders understand climate risk and make informed decisions.⁷ The NGFS scenarios should be the basis for efforts by the financial supervisors to provide a consistent basis for companies and investors to disclose their climate risk exposure.

However, the associated public database is currently limited to the energy sector and this is at a high level. The NGFS scenarios clearly show that the structure of global investment will need to change substantially over the coming years and decades (Figure 1) but further work is required to explore how these scenarios translate to investment opportunities in the Australian context.



Figure 1: Change in global energy sector investment to avoid large scale and systemic risks from climate change⁸



To begin filling this gap, IGCC commissioned Energetics to quantify the investment opportunities by sector and asset class associated with an orderly transition to net zero emissions in Australia, compared with a high global warming scenario. This brief summarises these results and the detailed results are available in the appendix. A technical assumptions document is also available on IGCC's website.



ORDERLY TRANSITION VS A HOTHOUSE WORLD

To examine the investment opportunities associated with an orderly transition to net zero emissions by 2050, two scenarios were developed. These are based on the scenario frameworks recommended by central banks (the NGFS) in examining forward looking investment opportunities:⁹

1. **Orderly transition:** In this scenario, clear long-term policies and market signals promote a timely and orderly investment pathway to net zero emissions and limiting global warming inline with the objectives of the Paris Agreement (1.5°C to well below 2°C global warming). In line with agreements made in Paris and other major economies,¹⁰ Australia updates its 2030 target to a 45 per cent reduction on 2005 levels and sets a target of net zero emissions by 2050. Governments continue to play a role in supporting research, development and early stage deployment of technologies. Through time, the private sector plays an increasingly more active role in the investment in new and emerging industries as confidence in regulatory frameworks, technologies and new markets emerge.
2. **Hothouse scenario:** Under this scenario, global and Australian emissions are reduced in line with current international commitments (excluding the China net zero commitment made in September 2020)¹¹ leading to severe climate change impacts on economies. After 2030, Australia's emissions continue to fall at the same rate as required to achieve the current 2030 target of -26% to 28%. National emissions reach zero sometime in the second half of this century. In this scenario, there is no clear, long-term framework to promote the efficient allocation of capital across the economy. This leads to the public sector carrying a disproportionate load of the investment required to achieve emissions targets. This scenario is characterised by ongoing climate policy uncertainty. While policy settings remain at levels insufficient to achieve the Paris Agreement goals, the risk that they will be strengthened in the future is factored into investment decisions.

The analysis considered investments in clean technology solutions that must happen to achieve an orderly transition pathway for Australia, or the 'minimum viable capital investment' to achieve net zero emissions in an orderly way by 2050. In addition to this, opportunities were only considered if they met three criteria: 1) capital investments in Australia, 2) investments which are at scale, and 3) investments which are additional, rather than business-as-usual energy efficiency upgrades. The analysis did not seek to capture all investment occurring within the economies described by the scenarios, but rather to capture the Australian investment opportunities in which institutional investors could participate.

The potential for Australian clean technology creators (of solutions such as green hydrogen and green steel) to service overseas markets can be expected to increase the investment opportunities significantly.¹² These opportunities are considered secondary opportunities which are made more viable through certainty and ambition of climate and energy policy, as modelled in the orderly transition scenario.

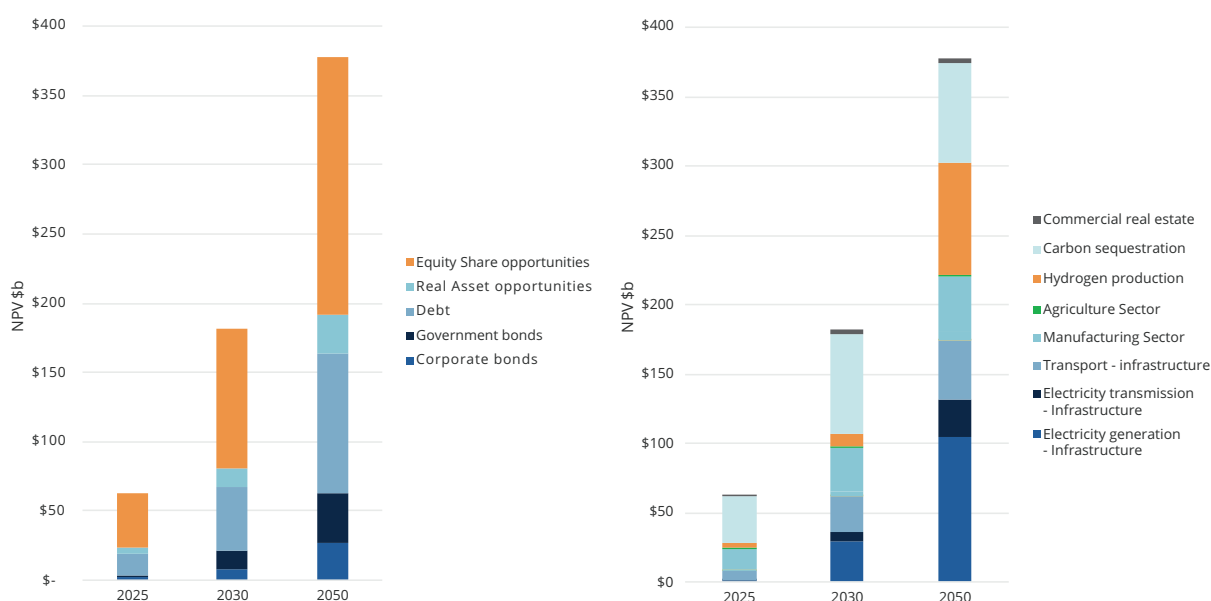


UNLOCKING THE BILLIONS: INVESTMENT OPPORTUNITIES IN ZERO EMISSIONS

Boosting the economic recovery in the short term

An orderly transition to net zero emissions would unlock around \$63 billion in total investment to 2025 (Figure 2). Over the next five years emissions abatement in the manufacturing sector (\$15 billion), transport infrastructure such as charging stations for light and heavy vehicles (\$6 billion), and green hydrogen production (\$3 billion) are the biggest investment opportunities in the energy and industrial sectors.

Figure 2: Investment by asset class and sector under orderly transition scenario - Total to 2025, 2030 and 2050



Carbon sequestration also emerges as its own major investment asset class as all sectors invest in offsets through nature-based solutions to achieve their net zero emissions targets and other medium-term goals (\$33 billion). This provides an illustrative example of the innovation scale required to achieve emissions reductions aligned with the objectives of the Paris Agreement.

As an asset class investment in carbon sequestration activities on land and in the ocean is a relatively immature area of institutional investor activity,¹³ This underpins the central importance of clear, durable and long-term policy signals to net zero emissions. Without this the market will not have the confidence for investors and companies to scale-up this industry in a relative short period of time to meet growing corporate-sector demand.



Mapping the multi-billion dollar opportunity in the medium term

Investment in renewable and clean electricity production through the period 2020 to 2050 is the sector that will emerge as the largest investment opportunity over all (\$385 billion). After 2030, commercial scale opportunities in green hydrogen production hit scale, leading to substantial investment in this emerging industry. By 2050, green hydrogen is the second largest investment opportunity at nearly \$350 billion. The next largest opportunities to 2050 are transport infrastructure (\$104 billion), carbon sequestration (\$102 billion), and electricity transmission and distribution (\$98 billion).

Equities and private sector debt finance are the biggest opportunities by asset class. In nominal terms, to 2050, equities make up around half the total investment (\$525 billion) and debt accounts for around a quarter with \$322 billion of opportunities, with government and corporate bonds representing \$115 billion and \$101 billion respectively. The structure of finance is driven by lower regulatory risks and the broad uptake of clean technologies, which increases incentives for the private sector to build and operate infrastructure assets.

Little upside in business as usual

There is little upside in the Hothouse scenario where communities, the private sector and the public sector don't work together towards a net zero emissions economy. Under this scenario, weaker emissions reduction targets, greater regulatory risks (See Box: Policy risks to institutional investment in a net zero emission pathway) and the government crowding out private sector investment all limit private sector opportunities.

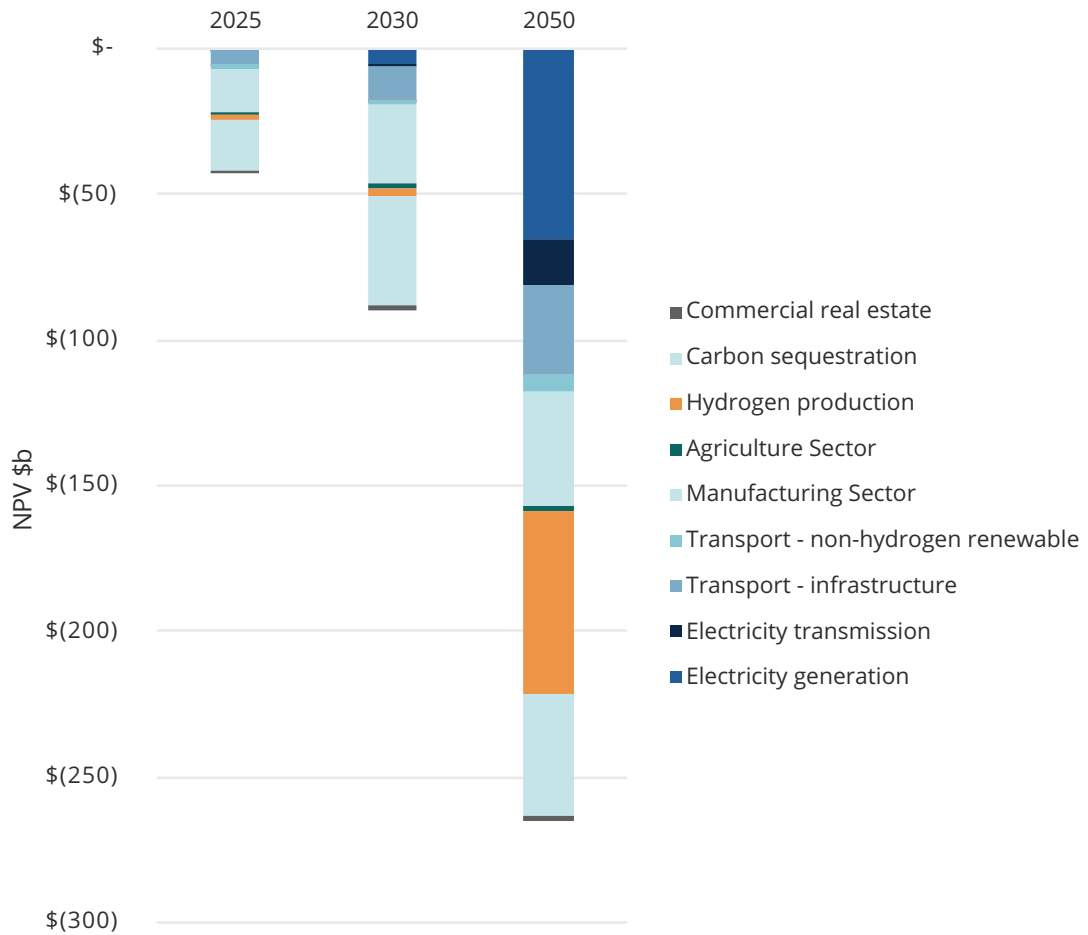
Total investment in the economy falls significantly under the hothouse scenario compared to the orderly transition scenario (Figure 3). By 2025, lost investment opportunities relative to an orderly transition total -\$43 billion and are most prevalent in the manufacturing sector (-\$14.7 billion), transport infrastructure (-\$5.3 billion) and green hydrogen production (-\$1.4 billion). Carbon sequestration does not develop as a large asset class (-\$18 billion).

By 2050, lost investment opportunities balloon to around -\$265 billion. By sector, the largest losses are renewable and clean electricity production (-\$65 billion), green hydrogen production (-\$63 billion), carbon sequestration (-\$42 billion), abatement in the manufacturing sector (\$39 billion) and transport infrastructure (-\$31 billion).

Critically, in this scenario, the government must play a much bigger role in stimulating investment to achieve emissions goals. Regulatory risk and limited uptake of clean technologies due to weaker emissions targets result in patchy investment and limited experience in clean technologies. The less the private sector invests, the higher the cost for government and in turn the taxpayer. The government builds more infrastructure as a share of total work, as the private sector decreases its involvement due to increased risks as well as reduced and uncertain returns.



Figure 3: Change in investment by sector under hothouse vs an orderly transition scenario - Totals to 2025, 2030 and 2050





Policy risks to investment in a net zero emissions transition

Australian markets and companies are increasingly competing for international capital against peers operating in jurisdictions with more durable policy conditions. Investment in zero emissions assets is impacted by factors that long-term investors manage on a day-to-day basis (e.g. political instability, currency risk, financial risks). However, there are a number of well recognised barriers specific to institutional investment in zero and low emissions technologies, in particular the absence of a clear price and market signals to reduce emissions.¹⁴ These investment risks are more acute in Australia due to a history of ad hoc policy interventions, a piecemeal approach to energy and the lack of a bipartisan, long-term approach to climate policy.

Investors consider policy uncertainty and practical investment challenges as the key barriers to investment in climate solutions. Over 40 per cent of investors have signaled that regulatory risks are a key barrier to climate-aligned investment in Australia.¹⁵ Whilst the response from some investors is a 'wait and see' approach, delaying their investments particularly for large private investments in infrastructure, other investors continue to deploy their capital offshore. It's likely investors do both.

A gas-fired recovery?

There has been significant political discussion in Australia as to the role of gas infrastructure investment in support of the economic recovery from the COVID-19 pandemic. The extraction, transportation and use of gas produces significant amounts of greenhouse gas emissions. From a long-term investor's point of view, gas carries the same types of climate risk as any other fossil fuel. Changes in climate policies in key export markets (e.g. China and South Korea), lower cost technology alternatives, incorporation of new fugitive emissions estimates and Scope 3 emissions into carbon risk analysis and a lack of social licence or market sentiment, can all prompt value reassessments of a large range of assets in the gas sector.

When making decisions on emissions-intensive gas infrastructure that have an operational life of several decades, investors must consider the risk that the asset will become stranded as climate policies are tightened over time and the economics of zero emissions energy production continues to undermine the financial viability of fossil fuels. This will be the case even if Carbon, Capture and Storage (CCS) is applied. The additional costs associated with the capture, transportation and storage of carbon dioxide make these technologies even less economic compared to other low emissions options.

As a result, global capital markets will increasingly scrutinise the climate risks associated with gas, leading to preferential investment in true zero emissions alternatives. This is borne out in the Energetics modelling which shows no large scale investment in gas power generation or infrastructure under either scenario as renewable energy and storage are cheaper alternatives.



IMPLICATIONS FOR INVESTORS

The world is now seeking to address the COVID-19 pandemic and rebuild battered economies. At the same time, institutional investors have a fiduciary duty to consider climate change risks in their investment strategies and financial authorities are requiring the entities they regulate to measure and disclose climate-related risks and opportunities.¹⁶ For many investors, the conversation has moved on from meeting the objectives of the Paris Agreement being an 'if' to a 'how', and what that means for their invested capital.

In this context investors, communities, business and governments are making decisions that will shape economies for decades to come. Capital markets are hungry for net zero opportunities and wary of climate-sensitive assets and industry sectors. As countries seek to attract private capital to stimulate the economy, countries which integrate long-term opportunities, such as achieving net zero emissions by 2050, and mitigate risks, such as the impacts of climate change, will be in a better position to attract global private investment.

What this looks like in practice will be different for each market. This is the first attempt in Australia to quantify the investment opportunities associated with an orderly transition to a net zero emissions economy.

This analysis points to the sheer scale of the investment opportunity associated with an orderly transition to net zero emissions by 2050. The billions of dollars identified in the short and long term would support the jobs and livelihoods of millions of Australians. Many of these prospects are in regional Australia with multi-billion dollar opportunities in forestry, renewable energy and energy and transport infrastructure, and advanced manufacturing. These are opportunities we cannot afford to ignore.

Unlocking the billions is a partnership

Public and private sectors will need to work together to achieve a resilient net zero emissions economy. With trillions of dollars in capital under their management, investors will be critical to addressing the two challenges of accelerating the recovery from COVID-19 and addressing climate change. This is particularly the case as governments will be more fiscally challenged after deploying immediate COVID-19 relief, and therefore unlocking private capital will be critical to both recovery and net zero investment opportunities.

However, this is not an easy challenge. The world is still grappling with what net zero means for communities, businesses, investors and governments.

To provide clarity and direction on how investors, companies and governments can unlock climate change opportunities and manage risks, IGCC is working with other major investor organisations, disclosure organisations and UN bodies under the Investor Agenda to define a framework of collective action to achieve net zero emissions.¹⁷

Table 2 applies this emerging framework to the action required across the Australian economy to unlock large-scale investment in the short, medium and long-term term. Many of these priorities have themes that are cross cutting. For example, regulator policies that support mandatory reporting aligned with the Task Force for Climate-related Financial Disclosures (TCFD) framework can improve the quantity and quality of disclosures, thereby enhancing and supporting company engagement and informing investor practices.



Table 2: Policy, company engagement, investment and disclosure priorities to unlock opportunities in an orderly transition to net zero emissions.¹⁸

<h2 style="text-align: center;">CLIMATE RESILIENT NET ZERO EMISSIONS ECONOMY BY 2050</h2>			
<p>Policy: National policies aligned with delivering a just and orderly transition to a net zero emissions economy by 2050¹⁹</p>	<p>Company engagement: Collaboration between investors and companies they own. Engagement via participation in initiatives like Climate Action 100+ that focus on emissions reductions in line with Paris Agreement objectives</p>	<p>Investment: Reorienting investor portfolios and business strategies to manage systemic climate risks and enable investors and businesses to succeed in a net zero future</p>	<p>Disclosure: Enhancing climate-related disclosures aligned with the TCFD to support investor and company action to access climate change opportunities and risks</p>
<h3 style="text-align: center;">IGCC short-term priorities to unlock investment opportunities</h3>			
<p>Pathways to net zero emissions by 2050: Durable national emissions and economic strategies aligned to the Paris Agreement</p>	<p>Net zero company strategies and action: Align strategy to achieve net zero emissions by 2050. Implement a robust decarbonisation strategy to deliver these reduction targets including the company's capital investments are consistent with a just transition to net zero emissions by 2050</p>	<p>Net zero emissions climate change roadmaps: Investors put in place and implement a climate change policy and roadmap consistent with the goals of the Paris Agreement. This includes analysing and assessing climate change-related risks and opportunities (e.g. through scenario analysis)</p>	<p>Company reporting: All significant companies must disclose climate-related financial risk in a form that: is aligned with the TCFD recommendations; provides decision-useful and investable information; and clearly defines how the companies' approaches to managing climate-related risks and opportunities is being implemented²⁰</p>



<p>A managed energy sector transition: The credible integration of climate change and energy policy, and a policy for a just transition in the energy system</p>	<p>Short to medium-term actions: Companies set clear short, medium and long-term emissions reduction targets or goals covering all material scope 1, 2 and 3 emissions</p>	<p>Net zero aligned investment: Investors integrating Paris-aligned emissions reduction goals and invest consistent with their policy.²¹ This can include investing in zero or low-carbon investment funds and other products (e.g. low carbon indices, climate-aligned bonds)</p>	<p>Investor reporting: Investors must report against the TCFD recommendations and ensure investment strategies are consistent with this disclosure</p>
<p>Building resilient communities and economies: National climate change adaptation strategies and strengthened climate-related disclosure requirements for companies and investors</p>	<p>Policy advocacy: Both investors and companies have a clear commitment and set of disclosures to support climate policy in line with the objectives of the Paris Agreement and a demonstration of how direct and indirect lobbying by industry bodies is consistent with this intent</p>	<p>Investing in adaptation and resilience: Undertaking a physical risk exposure assessment and investing in adaptation solutions to build resilience</p>	<p>Reporting on physical risk: Relevant entities must disclose portfolio-wide and asset level exposure to physical risk and adaptation measures to strengthen resilience</p>

Critically, this framework demonstrates that the public and private sectors will need to work together to achieve a resilient net zero emissions economy. This is particularly the case as governments will be more fiscally challenged after deploying immediate COVID-19 relief, where unlocking private capital will be critical to both recovery and net zero investment opportunities. Economic recovery efforts are best directed to where investment and job creation can be matched with net zero emissions energy, industrial, building and transport systems, along with climate resilience measures and other sustainable infrastructure that will strengthen our communities.

IGCC will continue to work with governments and investors to pursue a policy response that delivers a prosperous economy.



APPENDIX: DETAILED MODELLING RESULTS

Estimated value of investment needed to meet the abatement trajectories assumed in each scenario. A technical assumptions document is available on IGCC's website.

Orderly transition scenario

Asset Class

Investment Opportunities (\$B)	PV to 2023	PV to 2025	PV to 2030	PV to 2035	PV to 2040	PV to 2045	PV to 2050	Nominal Total
Corporate bond opportunities	1.0	2.0	5.1	7.9	11.7	21.6	26.9	100.7
Government bond opportunities	0.9	1.9	6.0	13.8	22.9	30.5	35.3	114.6
Loan opportunities	8.3	15.6	32.8	45.7	59.4	88.8	101.9	322.4
Total Debt opportunities	10.3	19.5	43.9	67.5	94.1	140.9	164.1	537.8
Real Asset opportunities	2.4	4.5	9.5	12.9	16.4	24.0	27.3	83.9
Equity Share opportunities	21.2	38.7	77.5	101.3	123.4	168.4	185.8	525.5
Total equity opportunities	23.6	43.3	87.0	114.2	139.8	192.4	213.1	609.4
Total investment opportunities	33.8	62.8	130.9	181.7	233.9	333.3	377.2	1,147.2

Sector

Investment Opportunities (\$B)	PV to 2023	PV to 2025	PV to 2030	PV to 2035	PV to 2040	PV to 2045	PV to 2050	Nominal Total
Infrastructure								
Electricity generation Sector Opportunities	0.3	1.2	10.3	28.9	56.4	82.7	104.7	385.6
Electricity transmission Sector Opportunities	0.0	0.3	2.7	7.4	14.6	21.2	26.7	97.8
Gas power generation and transmission Sector Opportunities	-	-	-	-	-	-	-	-
Transport - infrastructure Sector Opportunities	3.3	6.3	12.8	25.5	35.6	42.3	42.3	104.0
Total Infrastructure opportunities	3.7	7.8	25.7	61.8	106.7	146.2	173.6	587.4
Non-infrastructure								



Mining and metals Sector Opportunities	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Transport - non-hydrogen renewable fuels Sector Opportunities	0.9	1.5	2.8	3.9	4.8	5.9	6.9	19.5
Manufacturing Sector Opportunities	9.2	14.7	26.3	30.8	34.4	37.0	39.1	79.5
Agriculture Sector Opportunities	-	1.2	1.7	1.7	1.7	1.7	1.7	2.3
Hydrogen production Sector Opportunities	2.0	3.4	5.8	8.8	11.3	67.2	80.5	349.0
Forestry and land Management Sector Opportunities	17.1	32.7	66.0	71.8	71.8	71.8	71.8	102.5
Commercial real estate Sector Opportunities	0.9	1.4	2.5	2.9	3.1	3.4	3.5	6.9
Total non-infrastructure opportunities	30.1	55.0	105.2	119.9	127.2	187.1	203.6	559.8
Total investment opportunities	33.8	62.8	130.9	181.7	233.9	333.3	377.2	1,147.2

Hothouse scenario

Asset Class

Investment Opportunities (\$B)	PV to 2023	PV to 2025	PV to 2030	PV to 2035	PV to 2040	PV to 2045	PV to 2050	Nominal Total
Corporate bond opportunities	0.2	0.3	0.8	1.1	1.6	2.3	2.7	15.8
Government bond opportunities	0.2	0.6	2.6	7.0	13.8	20.2	24.6	159.2
Loan opportunities	1.5	2.9	6.4	9.0	11.9	16.7	18.9	101.0
Total Debt opportunities	1.9	3.9	9.8	17.1	27.4	39.2	46.2	276.0
Real Asset opportunities	0.9	1.6	3.1	4.0	4.9	6.1	6.6	28.8
Equity Share opportunities	7.8	14.3	28.1	36.3	43.8	55.1	59.7	258.9
Total equity opportunities	8.6	15.9	31.2	40.3	48.6	61.3	66.3	287.6
Total investment opportunities	10.6	19.8	40.9	57.4	76.0	100.5	112.5	563.7



Sector

Investment Opportunities (\$B)	PV to 2023	PV to 2025	PV to 2030	PV to 2035	PV to 2040	PV to 2045	PV to 2050	Nominal Total
Infrastructure								
Electricity generation Sector Opportunities	0.3	0.9	4.6	10.9	22.1	32.1	39.4	256.3
Electricity transmission Sector Opportunities	0.0	0.3	1.9	3.7	6.7	9.3	11.1	68.2
Gas power generation and transmission Sector Opportunities	-	-	-	-	-	-	-	-
Transport - infrastructure Sector Opportunities	0.6	1.1	2.0	6.5	9.6	11.5	11.5	46.4
Total Infrastructure opportunities	0.9	2.3	8.6	21.1	38.3	52.9	62.0	371.0
Non-infrastructure								
Mining and metals Sector Opportunities	-	-	-	-	-	-	-	-
Transport - non-hydrogen renewable fuels Sector Opportunities	0.1	0.2	0.4	0.6	0.7	0.8	0.9	4.2
Manufacturing Sector Opportunities	-	-	-	-	-	-	-	-
Agriculture Sector Opportunities	-	-	-	-	-	-	-	-
Hydrogen production Sector Opportunities	1.2	2.0	3.1	4.3	5.2	14.8	17.5	131.7
Forestry and land Management Sector Opportunities	7.9	14.7	27.9	30.0	30.0	30.0	30.0	49.3
Commercial real estate Sector Opportunities	0.3	0.5	0.9	1.4	1.8	2.0	2.1	7.5
Total non-infrastructure opportunities	9.6	17.5	32.4	36.3	37.7	47.6	50.5	192.7
Total investment opportunities	10.6	19.8	40.9	57.4	76.0	100.5	112.5	563.7



REFERENCES

1. Energetics has contributed to this report in good faith using information in the public domain and provided by the Investor Group on Climate Change (the IGCC) and we accept no liability for any errors. Energetics has provided this advice in its capacity as advisors solely for the benefit of the IGCC for whom our analysis was prepared. The analyses in this report may not have considered issues relevant to any third parties and accordingly, to the extent permitted by law, Energetics disclaims all liability for any and all costs, loss, damage and liability that any third party may suffer, incur or is likely to suffer or incur, arising from or relating to this report. While all care and diligence have been used to construct this report, the information, statements, statistics and commentary (together the 'information') within this report (including attachments), may not be accurate, current or complete in all respects and, consequently, Energetics does not make any representations or warranties as to the accuracy, currency or completeness of this information. Any commercial decisions taken are not within the scope of our duty of care, and in making such decisions, you should take into account the limitations of the scope of our work and other factors, commercial and otherwise, which you should be aware of from sources other than our work. Under no circumstances, including negligence, shall Energetics be liable for any direct, indirect, incidental, special or consequential damages or loss of profits that result from the use or inability to use this report and/or attachments. Energetics shall not be liable for any such damages including, but not limited to, reliance by a third party on any information obtained from this report and/or attachments; or reliance by you or a third party that result from mistakes, omissions, interruptions, deletion of files, viruses, errors, defects, or failure of performance, communications failure, theft, destruction or unauthorised access. Where liability cannot be excluded, any liability incurred by you or anyone else in connection with the use of this report and/or attachments, is limited to the extent provided for by law. This report and any attachments may contain legally privileged or confidential information and may be protected by copyright.
2. See stimulus data from The Smith School Tracker of Recessionary Fiscal Stimulus (O'Callaghan et al. 2020); Hepburn and O'Callaghan at Centre for Policy Development (2020): <https://cpd.org.au/wp-content/uploads/2020/09/COVID-19-fiscal-recovery-stimulus-to-win-on-economics-and-climate-Hepburn-and-O'Callaghan-1.pdf> For background on national emissions targets see Climate Action Tracker (2020): <https://climateactiontracker.org>. Trade data from DFAT (2020): <https://www.dfat.gov.au/about-us/publications/trade-investment/trade-at-a-glance/Pages/trade-at-a-glance>
3. O'Callaghan, Tritsch (2020), Briefing for Policymakers: Green Hydrogen as Fiscal Stimulus. Smith School Briefing Paper 20-03. See also Hepburn and O'Callaghan at Centre for Policy Development (2020): <https://cpd.org.au/wp-content/uploads/2020/09/COVID-19-fiscal-recovery-stimulus-to-win-on-economics-and-climate-Hepburn-and-O'Callaghan-1.pdf>
4. IGCC (2020a): https://igcc.org.au/wp-content/uploads/2020/10/Oct2020_Final-IGCC-Net-Zero-Investment-Report.pdf?mc_cid=6f-c6b3d4b3&mc_eid=5b69c7f4dc
5. WWF/EY (2020), <https://www.wwf.org.au/news/news/2020/wwf-report-bus-and-battery-led-covid-19-recovery-could-generate-100-000-jobs#gs.g90634>; Murphy (2020): <https://millionjobs.org.au/app/uploads/2020/09/Economic-Impact-of-the-Million-Jobs-Plan-from-Murphy-Economics-1.pdf>
6. NGFS (2020): https://www.ngfs.net/sites/default/files/medias/documents/820184_ngfs_scenarios_final_version_v6.pdf
7. AIGCC, IGCC (2020): https://www.aigcc.net/wp-content/uploads/2020/07/IGCCAIGCC_Policy-Briefing_NGFS_Final2.pdf
8. NGFS Scenario Explorer: <https://data.ene.iiasa.ac.at/ngfs>. Figure shows the change in annual investment (in 2030 and 2050) between a central 'hothouse' scenario and a scenario that limits warming to 1.5°C by the end of the century.
9. NGFS (2020): https://www.ngfs.net/sites/default/files/medias/documents/820184_ngfs_scenarios_final_version_v6.pdf. The physical impacts of climate change should be included in forward-looking national economic analysis. These costs were excluded from this analysis due to resource and methodological constraints. In addition, contrary to the NGFS scenario framework and IGCC's recommended approach on the use of scenarios in government processes, this analysis does not consider a "disorderly" transition scenario for the same reasons. Disorderly scenarios are characterised by late, disruptive, sudden and/or unanticipated economic risks triggered by governments, with companies and investors acting last to reduce climate risks. As a general principle, disorderly transition should be included in climate risk analysis as this is currently the most likely policy scenario.
10. See EC (2020): https://ec.europa.eu/clima/policies/strategies/2030_en and Farand, Darby (2020): <https://www.climatechangenews.com/2020/09/22/xi-jinping-china-will-achieve-carbon-neutrality-2060/>
11. Farand, Darby (2020): <https://www.climatechangenews.com/2020/09/22/xi-jinping-china-will-achieve-carbon-neutrality-2060/>
12. For example, Grattan Institute (2020): <https://grattan.edu.au/report/start-with-steel/>
13. IGCC (2020a): https://igcc.org.au/wp-content/uploads/2020/10/Oct2020_Final-IGCC-Net-Zero-Investment-Report.pdf?mc_cid=6f-c6b3d4b3&mc_eid=5b69c7f4dc



14. IPCC (2014): https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter16.pdf; OECD (2018): <https://www.oecd.org/cgfi/Investment-Governance-Integration-ESG-Factors.pdf>; IGCC (2020b): <https://igcc.org.au/wp-content/uploads/2020/06/IGCC-submission-technology-roadmap-FINAL.pdf>
15. IGCC (2020a): https://igcc.org.au/wp-content/uploads/2020/10/Oct2020_Final-IGCC-Net-Zero-Investment-Report.pdf?mc_cid=6f-c6b3d4b3&mc_eid=5b69c7f4dc
16. IGCC (2019b): https://igcc.org.au/wp-content/uploads/2020/06/IGCC_Policy-Briefing_Fiduciary-Duty_FINAL_1.pdf
17. AIGCC, CDP, Ceres, IGCC, IIGCC, PRI, UNEP FI: <https://theinvestoragenda.org>
18. IGCC (2019c): <https://igcc.org.au/wp-content/uploads/2020/07/IGCC-in-2022-investing-for-climate-resilient-net-zero-emissions-economy.pdf>
19. IGCC (2019d): https://igcc.org.au/wp-content/uploads/2020/06/Policies-for-a-resilient-economy_FINALa.pdf
20. IGCC (2020e): https://igcc.org.au/wp-content/uploads/2020/09/IGCCReport_Full-Disclosure_FINAL.pdf
21. IGCC (2020a): https://igcc.org.au/wp-content/uploads/2020/06/Feb2020_IGCC-Zero-Emissions_FINAL-2.pdf