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Toward a Net Zero Queensland

Economic impact analysis of the 75% interim emissions reduction target by 2035

Deloitte Access Economics

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Insights

Queensland has a $430B economic opportunity from an orderly transition to meet the 75% target by 2035.

The impacts of climate change are hitting businesses and communities, and the costs of a protracted transition are rising.[1] In response, the global economy – and particularly high emitting businesses – are ramping up investment in the technologies and the talent required to achieve their decarbonisation targets.

This accelerated effort means there is fast-rising competition for investment, workers and technologies that will deliver global decarbonisation, as assets that rely on fossil fuels need to be increasingly replaced.

As economies across the world race to make this change, they want a larger share of new and expanding industries to deliver growth and create jobs. Queensland's response to this dynamic will determine the economic costs and opportunities for the state's economy as it moves towards net zero.

Queensland's economic strengths come from trade and its connectivity to global markets. But where these strengths are emissions-intensive, they are vulnerable in the global race to net zero. Economies like Queensland need to keep up with the pace of global change to remain dynamic and competitive in a net zero world.

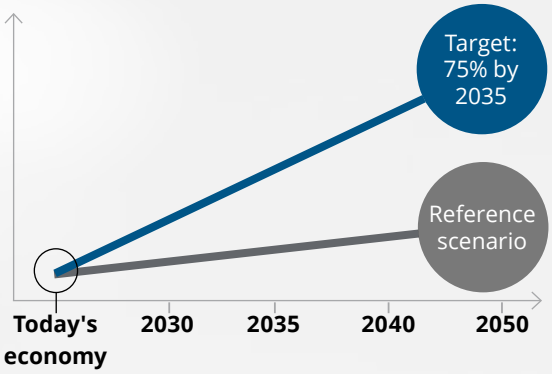
This report models and assesses how a 75% interim emissions reduction target by 2035 impacts Queensland, and how that target positions the economy for opportunities in a net zero world.

On the 75% by 2035 path Queensland's economy is larger, has more jobs and expands low-emission industry and exports so that it can better support decarbonisation across the rest of the world. An orderly transition to meet the 75% target by 2035 creates a $430 billion economic opportunity for Queensland.[i]

[i] Net present value of the incremental change in Gross State Product (GSP) of "75% by 2035" compared to the Reference Scenario using a 2% social discount rate.

Modelling the economic impacts of Queensland's path to net zero emissions.

Figure 1: Economic scenario framework used in this report



Target: 75% by 2035

The Target Scenario shows the economic impacts to Queensland from becoming net zero emissions by 2050 with a 75% by 2035 interim emissions reduction target. The scenario considers additional policy effort to support meeting the interim target on the path to net zero.

Reference scenario: No further action

Establishes the economic impacts to Queensland from no further action to decarbonise from today as Australia and the world accelerate emissions reductions. Against this, the economic impacts of the 75% by 2035 target are analysed.

Sustainable economic development depends on quickly, but carefully, moving towards net zero. 75% by 2035 enables this, attracting over $270B of new investment into Queensland to 2050.

Securing long-term economic growth, stable job creation and new industry development requires planned investments, early abatement, and competitive integration of Queensland businesses into complex global supply chains that are technologically advanced.

For Queensland, a higher interim emissions reduction target acts as an economic guardrail to coordinate public and private sector effort, at scale, to achieve these outcomes. The 75% by 2035 target catalyses new investment, workforce change and a reengineering of local supply chains to both replace emissions-intensive activity (such as industrial fuel use) and expand new low-emission industry (such as hydrogen).

Backed by $270 billion in additional investment (public and private) to 2050, Queensland's industries transform what they produce, how they produce it and generate new economic growth from this.[ii] Significant investment and industry growth adds 87,000 jobs to the economy in 2035 as industries like construction, clean energy generation, critical minerals, and green hydrogen scale development, invest in new technologies and attract workers.[iii]

When the Queensland economy achieves the 75% by 2035 target, industries which were previously focussed on decarbonising now increasingly compete in global markets and get a return on their low-emission investments. Queensland's hydrogen and utilities industries, for example, grow by an average of 5% each year to 2050. And the investments made to meet the interim target and transform industry capability create a significant job dividend by the time Queensland is net zero emissions, adding 145,000 jobs to the economy in 2050.

75% by 2035 keeps industry globally competitive. Queensland faces significant economic costs if it delays or slows its transition to net zero, risking $350B of exports by 2050.

Queensland needs coordinated policies to maximise clean energy use, boost trade, and grow its economy. Targeting an early and ambitious emissions reduction goal, like 75% by 2035, aligns Queensland with global decarbonisation trends and makes the economy more competitive. Missing this opportunity risks economic setbacks from:

01. Inadequate utilisation by industry of expanded clean energy capacity from the Queensland Energy and Jobs Plan (QEJP), meaning that investments in QEJP do not generate full economic returns.

02. A lack of active participation in decarbonisation, resulting in less economic cooperation from trade partners, trade penalties, higher technology costs, and slow development of low-emission technologies.

03. Increased financing costs for industries, households and government due to higher exposure to climate risks and the transition process.

A less orderly approach to reduce emissions could result in a smaller economy and lost trade opportunities for Queensland. If it remains emission-intensive, the Queensland economy could miss out on $350B in additional exports by 2050 due to the costs of delayed transition and lost economic potential.[iv]

[ii] Net present value of the incremental change in public and private capital investment of "75% by 2035" compared to the Reference Scenario using a 2% social discount rate.

[iii] All job figures are measured in full-time equivalent values and show the incremental change in employment of "75% by 2035" compared to the Reference Scenario. Jobs should be interpreted as the additional level of employment the activity in the economy supports each year.

[iv] Net present value of the incremental change in total exports of "75% by 2035" compared to the Reference Scenario using a 2% social discount rate is used.

Regional Queensland delivers decarbonisation, growing investment by $218B and attracting over 85% of the new jobs created as the economy transforms to net zero emissions.

The growth in investment and low-emission industry expansion is concentrated in regional Queensland. Investment (public and private) in Central Queensland – Wide Bay is mainly driven by an expanding hydrogen industry, associated local services and new mining activity. There is $84 billion of additional investment in Central Queensland – Wide Bay by 2050. In North and Outback Queensland, there is an additional $134 billion in investment out to 2050 as renewable energy expansion, construction, and critical minerals mining ramp up activity. The development of sector emissions reduction plans will be critical to the realisation of this dividend by signalling to the private sector and ensuring appropriate transition supports are in place.

Regional Queensland industries can replace high-emission activities with low-emission ones under Queensland's policy settings and the efforts of businesses which deliver the 75% by 2035 target. The investment growth and increasing value of new export activity is also a significant driver of regional job creation. In 2050, there are 130,000 new jobs in regional Queensland – over 85% of the total new jobs in a net zero Queensland.

Queenslanders have a higher standard of living and business costs are reduced under the 75% by 2035 pathway to net zero.

Deloitte Access Economics developed two indexes to analyse the impacts on households and costs to businesses as Queensland meets the 75% by 2035 target on its path to net zero. The household index recognises the importance of affordability to reduce emissions (like switching to electric cars), and how industry changes also affect incomes like higher wages in in-demand industry. For business, the index examines how the transition influences the affordability of energy and technological changes needed to decarbonise.

The results show that achieving the 75% target by 2035 improves household living standards and reduces business cost pressures across Queensland. Significant employment and wage growth is expected in low-emission industries, especially in regional Queensland, attracting investment and job opportunities. All regions experience improvements in household living standards as the economy adjusts to meet the 2035 target.

Early investments in emissions reductions, such as in met coal mining, improve the long-term economic value of these sectors and enhance the affordability of doing business by 2050, particularly in North and Outback Queensland. Central Queensland – Wide Bay benefits from the growth of hydrogen and clean energy sectors, leading to early relief from business cost pressures and sustained improvements over time. Investment in renewable energy in South East Queensland and the Darling Downs results in improvements in business affordability as the state moves towards net zero.

Contents

Queensland's clean economy pathway in the global race to net zero

Queensland is accelerating to net zero in step with the global economy.

Over 100 countries, representing nearly 80% of the global economy, have committed to achieving net zero emissions, including Australia and its top trading partners.[2] These commitments have seen over 200 globally significant financial institutions implement divestment policies against emissions-intensive activity, like thermal coal mining and coal-fired power projects.[3] Net zero targets are reshaping financial markets, supply chains, trade, and the job market.

For long-term economic growth and investment attraction in Queensland, it is crucial the economy aligns with these global efforts. Diversifying exports and enhancing industrial competitiveness can reduce economic transition costs locally, particularly as Queensland's key trading partners pursue decarbonisation.

But simply setting net zero targets won't improve Queensland's competitiveness and exports in low-emission technologies and their related industries. To fully capitalise on the opportunities of a net zero world, Queensland must effectively manage the pace and scale of its emissions reduction efforts, moving quickly, but carefully, towards net zero in 2050.

Securing long-term economic growth and stable job creation requires planned investments, early abatement, and competitive integration of Queensland businesses into expanding and complex global supply chains.

Implementing higher interim emissions reduction targets, on the path to net zero, provides a framework for public and private sector collaboration. This can facilitate a smoother and more cost-effective transition for businesses, households, and the overall economy. Accelerated decarbonisation efforts can put Queensland in the lead in the global race to decarbonise.

A clear pathway to net zero: 75% emissions reduction by 2035.

In February 2024, the Queensland Government introduced the *Clean Economy Jobs Bill 2024* to Parliament for consideration. On passing, the Bill will legislate greenhouse gas emissions reduction targets, including a new target of 75% by 2035 and net zero emissions by 2050 based on 2005 levels.

Queensland is already expected to meet and exceed its current 2030 emissions reduction target of 30% below 2005 levels. As per the Queensland Government's Clean Economy Pathway: 75% by 2035 policy document, existing plans across a range of sectors and collaboration with the Commonwealth is anticipated to deliver Queensland at least 60% emissions reductions on 2005 levels out to 2035. Setting the 75% by 2035 target and further coordinating additional effort across all levels of government, industry and communities is expected to deliver the remaining emissions reductions required. This includes establishing sector emissions reduction plans for industries to ensure a well-managed transition to meet the interim target.

In this view, the 75% by 2035 target can act as the economic goal posts that catalyse new investment, workforce change and a reengineering of local supply chains to both replace emissions-intensive activity (such as fugitive emissions from mining) and expand new low-emission industry (such as green hydrogen). In setting and meeting this target, Queensland could avoid a significant burden and higher economic costs in the future, while setting industry up to competitively export and grow in a net zero global economy.

The analysis in this report assesses the economic impacts of the 75% by 2035 pathway.

This report models and assesses economically how the 75% interim emissions reduction target by 2035 impacts Queensland's economy and positions industry for opportunities in a net zero world.

Deloitte Access Economics' analysis for the Business Council of Australia concluded inaction on climate change could cost Australia's economy $3.4 trillion in lost Gross Domestic Product (GDP) over the next 50 years. For Queensland, the economic consequences of worsening climate damages and disasters are devastating to regional economies and jobs.

Previous analysis has established that the advantages of collectively addressing climate change and decarbonising far exceed the costs. Today, there is a growing focus on the implementation of net zero policies and setting interim emissions reduction targets to maximise economic benefits and minimise transition costs.

Scenario frameworks for economic modelling can be used to compare different types of action and policy settings designed to achieve net zero and alternative paths to decarbonisation (including not decarbonising).[4] These scenario frameworks can help determine impacts (benefits and costs) of any net zero pathway adopted.[5]

In this report, the core analysis compares a 75% by 2035 pathway to net zero against Queensland taking no further action to decarbonise from today, while Australia and the rest of the world accelerate to net zero emissions. The analysis offers an independent view to economic impacts of a 75% by 2035 target on the path to net zero.

The scenario framework enables several key questions to be addressed:

01. **Energy transition, emissions reductions and macroeconomic impacts:** What is the role of energy system change in meeting 75% by 2035? Does earlier and faster emissions reduction improve economic growth? What are the impacts to households and business of this course of action?
02. **Credibility and design of Queensland decarbonisation policies on the path to 75% by 2035:** Does public policy have a role in minimising economic cost and maximising economic benefit?
03. **Macroeconomic costs of delayed transition to net zero:** How does delayed or significantly slowed decarbonisation in Queensland affect employment, investment, and growth? What are impacts on household living standards and the costs of doing business? What does a lack of globally competitive policy in Queensland imply?

The analysis is undertaken using Deloitte Access Economics' peer-reviewed D.Climate model. The analysis combines the best available evidence on economic theory and climate science with an assessment of global, national and Queensland policy settings designed to deliver net zero economies.

Appendix A describes the technical method, specifications of the modelling, and limitations of results.

Previous analysis has well established that the advantages of collectively addressing climate change and decarbonising far exceed the costs of doing nothing.

Queensland faces significant economic costs if it delays or slows its transition to net zero.

Scaled investment, technological innovation and credible decarbonisation policies can lead to a global green industrial revolution – creating new industries, jobs, and technologies while mitigating climate change impacts. This benefits Queensland's climate, its economy, and its people.

But for Queensland to realise these benefits, it needs to transition away from high-emission industries and transform its supply chains. Queensland's industries also need to enhance competitiveness to have a significant role in delivering decarbonisation at home and abroad.

Deloitte Access Economics estimates if Queensland remains emission-intensive, the economy could miss out on $350B in additional exports due to the costs of delayed transition and lost economic potential.[v]

If Queensland does not keep up with global decarbonisation, it will miss seizing economic opportunities as trading partners accelerate change. This significantly lowers economic growth and job prospects due to three key risks:

01. **Energy investment has a limited return:** The pace of transitioning to clean electricity and its uptake greatly affect short-term economic impacts.[6] Queensland risks bearing the investment costs of clean energy without reaping the full economic advantages where generation expands but isn't fully utilised through electrification or maximising its benefits through integration across supply chains. Coordinated and credible policy is needed to make best use of clean energy and increase economic growth.
02. **Negative trade and industrial policy reactions:** Trade is key to achieving global net zero and is crucial for Queensland's economic and job growth. If an economy doesn't engage in meaningful decarbonisation, it risks reduced economic and technological cooperation and decreased trade, higher technology costs, and delays in developing low-emission technologies. Policies like carbon border taxes and local content requirements could also come into play, harming Queensland industry and economic growth.
03. **Higher cost of capital for firms and government:** Financial markets now factor in the risks associated with climate change and the shift to net zero emissions. Financing that supports low-emission activities is becoming cheaper, while financing for high-emission activities that could become obsolete or 'stranded' is getting more expensive.[7] Queensland's industries and households risk higher costs due to their greater exposure to climate change and the transition process. For government, it could impact demand for debt and increase credit risk.[8]

[v] All net present values in the report show the incremental change of a variable in "75% by 2035" compared to the Reference Scenario out to 2050 using a 2% social discount rate.

Economic modelling in this report

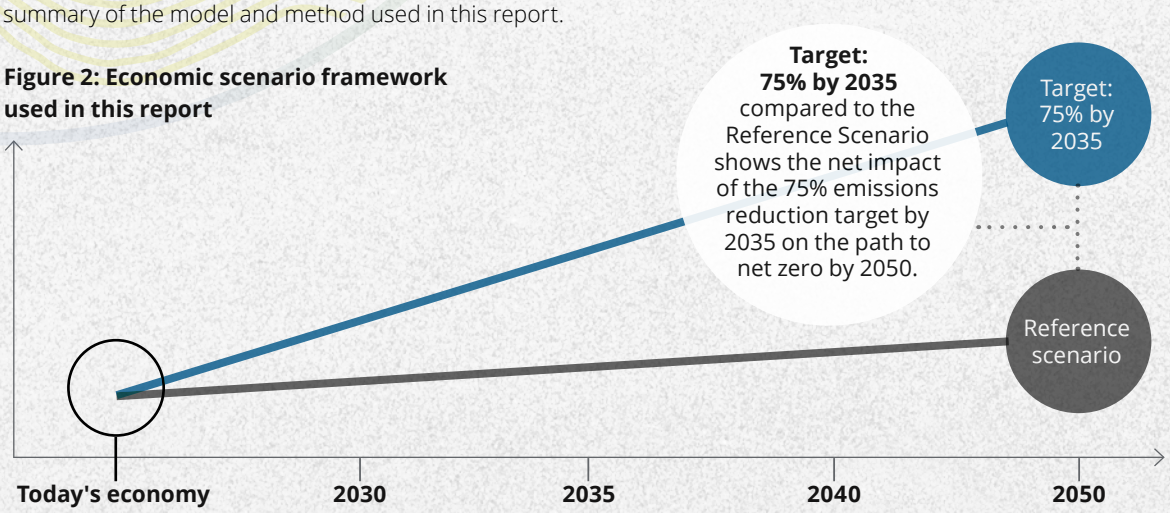
What model is used to analyse impacts of decarbonisation?

D.Climate is a climate-economy model developed by Deloitte Access Economics, reviewed by academic experts, and extensively applied across Australian governments and industry. The model shows how climate change, emissions from economic activity and the energy system interact, and the macroeconomic impacts of this. Appendix A provides a technical summary of the model and method used in this report.

How are the scenarios defined for modelling?

The results presented in the report reflect the Target: 75% by 2035 scenario, compared to the Reference Scenario. In these scenarios, there is a defined view on Queensland, Australia and the global economy in relation to climate change impacts, emissions, technological change and macroeconomic trends.

Figure 2: Economic scenario framework used in this report



Reference Scenario

Target: 75% by 2035

Queensland

Establishes the economic impacts to Queensland from no further action to decarbonise from today as Australia and the world accelerate emissions reductions. Against this, the economic impacts of the 75% by 2035 target can be assessed.

The Target Scenario establishes the economic impacts to Queensland from becoming net zero emissions by 2050 with a 75% by 2035 interim emissions reduction target. The scenario considers additional policy effort to support meeting the interim target on the path to net zero.

Australia

Australia follows the Commonwealth's baseline emissions projection to 2035, meeting net zero emissions by 2050 based on current policy measures.

Australia follows the Commonwealth's with 'additional measures' emissions projection to 2035. Meeting the 43% by 2030 emissions reduction target on the path to net zero emissions by 2050.

Global

The global economy is transforming, aligned to the Sustainability – Taking the Green Road Shared Socioeconomic Pathway (SSP1-1.9, see Table A5 in Appendix A), which delivers climate and decarbonisation targets that limit global average warming to 1.5°C by 2050. Under SSP1-1.9, the global economy experience low challenges to mitigation and climate change adaptation. The global energy mix broadly reflects the International Energy Agency's Net Zero Emissions by 2050 Scenario.

Source: Deloitte Access Economics

What is the emissions reduction profile for the Queensland economy?

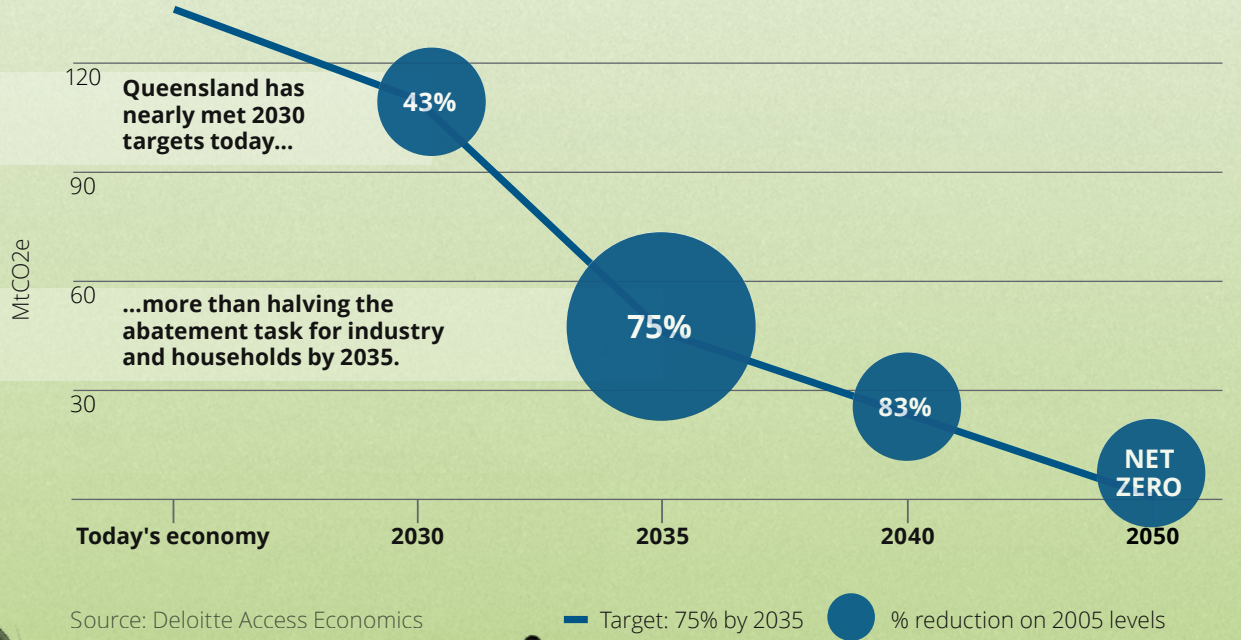
Queensland's economy has nearly met current 2030 interim reduction targets. From today, a 75% reduction in emissions by 2035 sees accelerated emissions reduction across all sectors, especially from clean electricity generation due to the Queensland Energy and Jobs Plan. These changes enable industry and households to quickly utilise clean electricity and rapidly reduce emissions.

Renewable energy powers an expanding electrification drive, replacing emissions-heavy processes with electric alternatives like vehicles, gas appliances and other industrial production processes. Investments in other clean energy sources like Sustainable Aviation Fuels (SAF) and green hydrogen also help industries transition to cleaner energy quickly, reducing emissions.

As industries and households adopt new, cost-effective technologies, emissions continue to drop to 2035. Accelerated emissions reductions more than halve Queensland's abatement task by 2035, lowering the economic cost to households, businesses, and government on the path to net zero.

Figure 3: Emissions reduction pathway
The 75% by 2035 emission pathway analysed in report

Under 75% by 2035



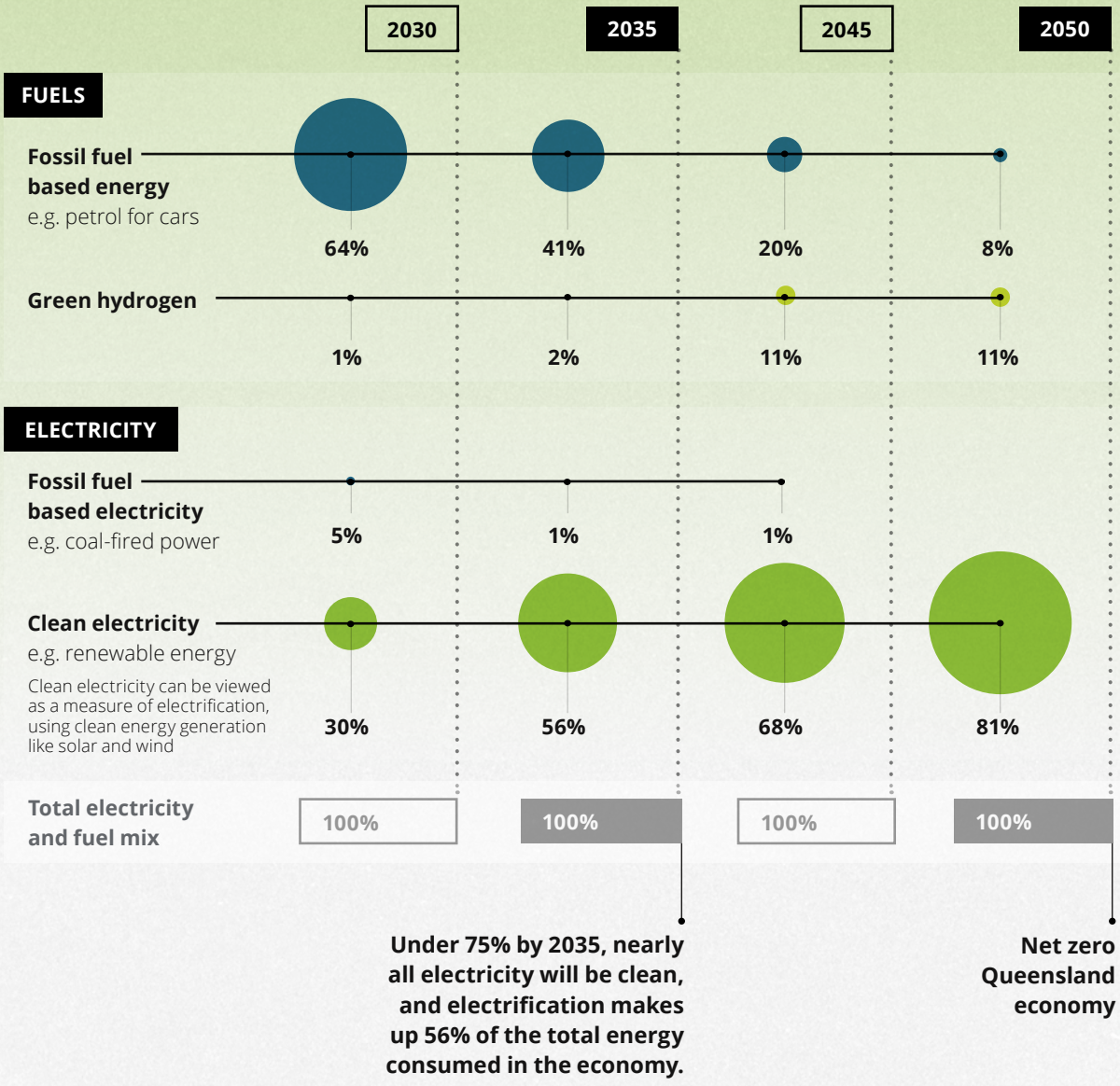
Source: Deloitte Access Economics

Queensland's electricity and fuel mix to deliver the 75% by 2035 target

Implementing the Queensland Energy and Jobs Plan and speeding up the shift to electric power, along with expanding into green hydrogen, transforms Queensland's energy sources under the 75% by 2035 pathway to net zero.

By 2035, the vast majority of Queensland's electricity will be from renewable sources, and more than half of all energy used in the state will come from electric processes. This switch to clean electricity is key to economic transformation towards net zero with transportation using electric vehicles, and industries like mining and manufacturing switching to clean energy sources, such as green hydrogen and renewable energy. Homes also electrify by replacing gas appliances with electric ones, for example.

Figure 4: Share of electricity and fuel type used in the Queensland economy
Electricity and fuel mix to deliver the 75% by 2035 target on the path to net zero



Source: Deloitte Access Economics

Note: shares of renewable electricity generation align to the Queensland Energy and Jobs Plan and AEMO's 2024 Integrated System Plan Step Change Scenario. There is a higher share of renewable electricity in the economy in the Target 75% by 2035 scenario due to expanded generation for green hydrogen. See Table A3 in Appendix A for more detail on assumptions underpinning the electricity and fuel mix.

Queensland's economic opportunity from 75% by 2035

75% by 2035 accelerates investment across Queensland to deliver significant economic opportunities. Queensland's growth depends on quickly, but carefully, moving towards net zero.

Securing long-term economic growth, stable job creation, and new industry development necessitates planned investments, early abatement, and competitive integration of Queensland businesses into growing global supply chains. Achieving 75% emissions reduction by 2035 facilitates this, attracting over $270 billion of new investment into Queensland through a well-managed industry transition out to 2050.

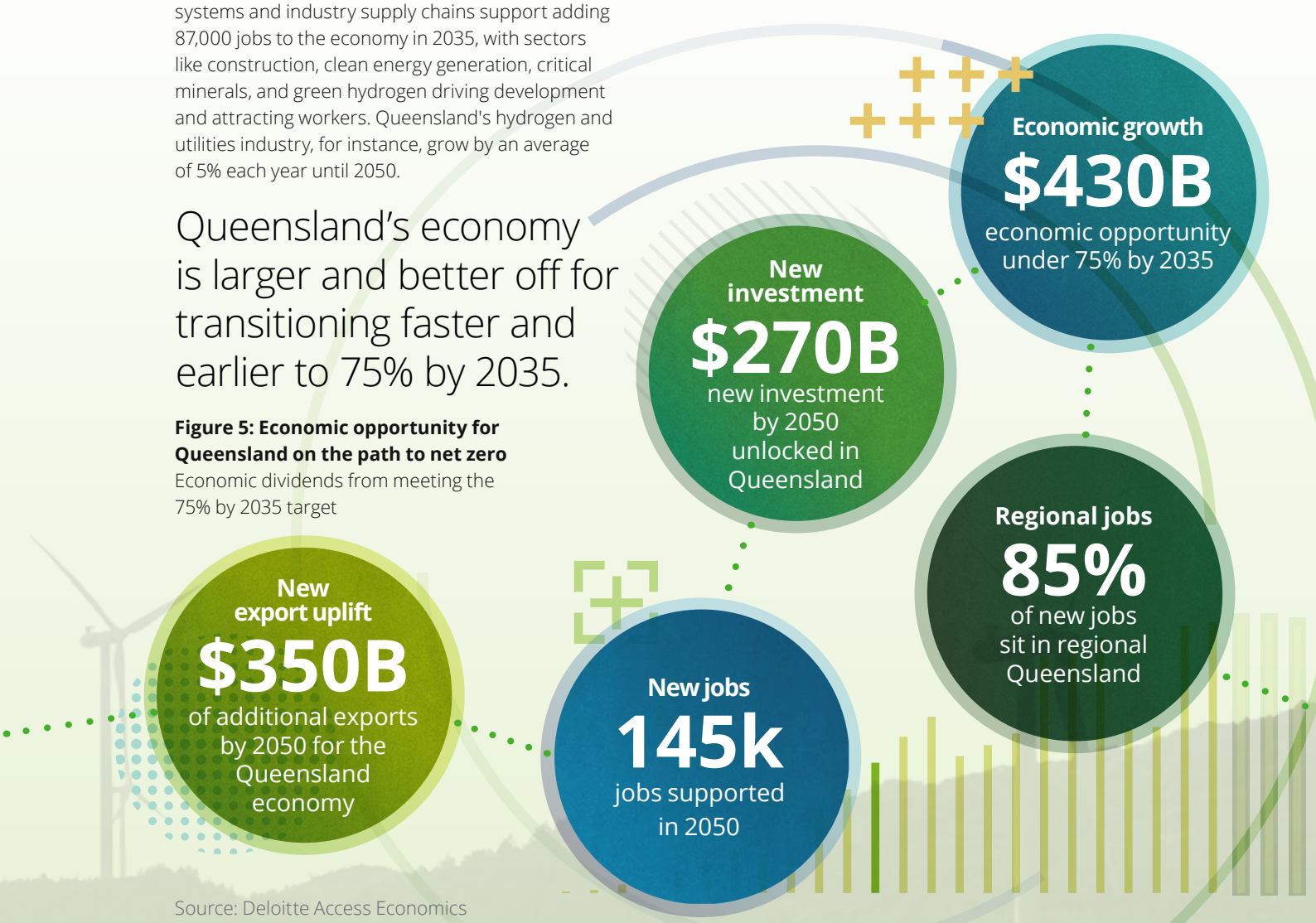
This accelerated investment, both public and private, drives transformation in Queensland's industries, leading to new economic growth. Transformed energy systems and industry supply chains support adding 87,000 jobs to the economy in 2035, with sectors like construction, clean energy generation, critical minerals, and green hydrogen driving development and attracting workers. Queensland's hydrogen and utilities industry, for instance, grow by an average of 5% each year until 2050.

A higher interim emissions reduction target coordinates efforts between the public and private sectors to achieve these outcomes at scale. As industries and the broader economy meet the 75% target by 2035, Queensland increasingly competes in global markets. The investments made to enhance industry capabilities and reduce emissions yield a significant employment dividend, adding 145,000 jobs to the economy in 2050.

Following the 75% by 2035 path, Queensland's economy expands, generating more jobs and boosting low-emission industries and exports to better serve a decarbonising world. Accelerated and coordinated transition creates a $430 billion economic opportunity for Queensland by 2050.

Queensland's economy is larger and better off for transitioning faster and earlier to 75% by 2035.

Figure 5: Economic opportunity for Queensland on the path to net zero
Economic dividends from meeting the 75% by 2035 target



Source: Deloitte Access Economics

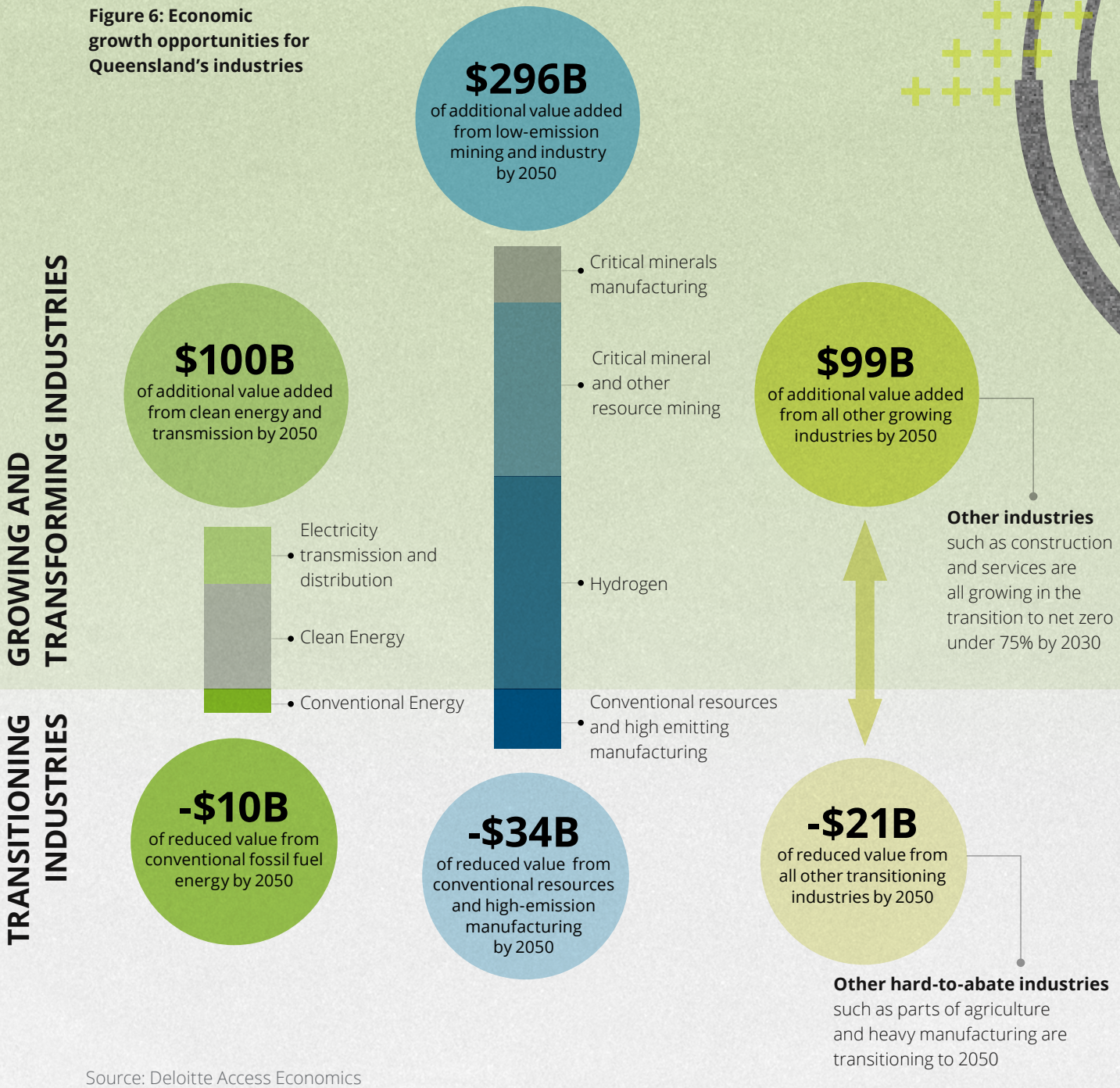
Note: All figures represent the net present value of the Target Scenario compared to the Reference Scenario by 2050. The jobs figure is the point-in-time gain in employment. The total export figure represents all industry exports for Queensland and is a 'net' figure, capturing both declining exports (e.g. thermal coal) and growing exports (e.g. critical minerals).

Industry Analysis

Economic growth opportunities for Queensland's industries

Queensland has an economic opportunity from bringing forward industry investment to meet 75% by 2035, creating the $430B economic opportunity for state to 2050.

Figure 6: Economic growth opportunities for Queensland's industries



Source: Deloitte Access Economics

Note: All figures represent net present value of change in industry Gross Value Added to 2050 using a 2% social discount rate.
All figures add to the $430B economic opportunity for Queensland's Gross State Product.

Industry transforms to compete in a low-emission world

From mine to market, Queensland's resources sector has world-leading talent and technology that support it to decarbonise under 75% by 2035.

The Queensland resources industry drives investment and economic growth. But as a trade-exposed industry, the global transition towards net zero demands an accelerated move away from high-emission activity to low-emission processes in mining to maintain competitiveness.

Tackling fugitive emissions early brings forward investments to grow Queensland's low-emission mining

Staying competitive means supporting low-emission mining activity that offer similar or better economic benefits to traditional mining resources. Decarbonisation is progressing in sectors like metallurgical coal for steel, which will still be needed even as the world becomes net zero,[9] and in critical minerals mining, which is essential for renewable energy technologies.

75% by 2035 brings forward investments in fugitive emissions reduction technologies, which refer to the unintentional release of emissions during mining and extractive operations[10], to produce lower emission metallurgical coal to supply globally. Over the next 25 years, export volumes are lower in Queensland's coal mining sector, but lower-emission metallurgical coal production is still valuable. The early technological transformation of metallurgical coal allows the remaining exports to continue contributing around $106 billion to the economy out to 2050.

Economic opportunities are realised through mining supply chain expansion and critical mineral growth

The need for a net zero global economy is reshaping traditional mining supply chains[11] – creating new opportunities for resource-intensive economies like Queensland to move along the supply chain, generating more value locally and increasing competitiveness in global markets.[12]

Leveraging Queensland's competitive advantages in mining talent and technology, there is a $170 billion economic opportunity from rapidly expanding critical minerals mining and other low-emission mining to 2050. Backed by almost $50 billion in additional investment, Queensland scales up production in both critical mineral mining and manufacturing to unlock $255 billion in new exports by 2050. This growth offsets the costs of transition in other hard-to-abate industries in Queensland and attracts workers into the sector.

Carefully designed policies and government coordination with industry are fundamental to enable workers and communities to adjust to changes affecting Queensland's resources industry. In 2050, critical minerals and other low-emission mining supports 27,300 additional jobs, with 75% of these new mining jobs sitting in regional Queensland. An additional 9,300 jobs are also supported in critical minerals processing and manufacturing across the state in 2050.

The reality of a world in which economies phase out fossil fuels reduces demand for Queensland's conventional emissions-intensive resources, a trend that businesses are already anticipating. On the 75% by 2035 path, economic output from Queensland's conventional resources (such as oil, gas, and high-emission coal mining) falls at an average annual rate of 5% to 2050 due to reduced global demand.[vi] Accelerated investment across the mining supply chain to develop low-emission activities and technologies also reduce the size of the conventional resources sector.

Queensland's resource sector grows, but it will have more low emissions-intensive resources such as critical minerals, and less of high emissions-intensive resources such as thermal coal. Sector plans can help manage this transition to minimise disruption and maximise the benefits.

[vi] All average growth rates reflect a compound average growth rate in % terms over the period from 2024-2050.

Green hydrogen fuels local industry expansion and exports a new commodity to rapidly decarbonising global markets.

Electrification using renewables is just one component of economy-wide decarbonisation. In hard to-abate sectors such as heavy industry and transport, industrial processes such as high-temperature heating, feedstock supply for chemicals, and heavy-duty freight make it hard to fully decarbonise with electrification alone.[13]

Green hydrogen is recognised as a potential breakthrough technology to overcome these challenges.[14] Successful large-scale production of hydrogen depends on several factors, notably location and access to essential services, markets, and infrastructure.[15] Queensland is already driving the development of a green hydrogen industry[16] to address these factors, but the 75% by 2035 target supports the hydrogen and utilities industries to grow by an average of 5% each year to 2050. The growth of hydrogen and utilities delivers an economic dividend of $51 billion to the Queensland economy by 2050.

The investments made to meet the interim target and transform industry capability create significant opportunity for employment across the hydrogen and utilities industries, particularly in Queensland's regions – supporting additional 10,500 jobs in 2050. These employment opportunities support the transition of workers from adjusting emissions-intensive industries and will require a mix of new roles – necessitated by new technologies – and existing trades and disciplines, which will be attracted into the hydrogen sector.[17]

Queensland farmers and agriculture are resilient to global change, decarbonising production under 75% by 2035 to continue to play a key role in providing sustainable food.

Queensland's agriculture and land industries are already feeling the effects of climate change. But the state's farmers and land managers are resilient, innovative, and already adapting. Queensland's 75% by 2035 path sees the industry almost double in size over the next 25 years, and from 2035 Queensland is competitive in global low-emission agricultural export markets.

Agriculture plays a crucial role in achieving net zero emissions, currently representing around 15% of Queensland's total emissions.[18] A current lack of low-cost commercially available mitigation technologies and implementation challenges, however, make agriculture a hard-to-abate sector.[19] On the 75% by 2035 path, Queensland's agriculture and land sector adapts to these challenges to play its part in helping Queensland become net zero.

Over the next 25 years, Queensland's agriculture and land sector sees a modest decline in the size of the workforce (just 0.1% per year on average). Given the seasonal nature of the agricultural workforce, low-skilled workers, such as seasonal fruit-pickers, are most likely to be impacted. The reasons for this employment adjustment are two-fold. Firstly, the trend of increased adoption of technologies results in greater agricultural labour productivity – not as many workers are required to produce the same level output.[20] Secondly, these workers who are no longer required in agriculture are attracted into fast-growing low-emission industries with higher wages, such as critical minerals mining and hydrogen.

Despite the need for structural transformation in the transition to net zero,[21] Queensland's agriculture and land industries reduce emissions while growing sustainably at an average annual growth rate of 2%.

Queensland's construction industry builds the transition to net zero, attracting significant investment and growth under 75% by 2035.

The construction industry is fundamental for supporting economic transformation and transition, building the infrastructure required to scale up industries like clean energy and green hydrogen. Construction activity will mirror development cycles of growing industries, experiencing significant growth during periods of transition as emerging industries demand its services, but also periods of growth moderation as developments are completed.

Queensland's construction industry experiences its highest growth prior to 2035, peaking at an annual growth rate of 5% in 2030, as the economy rapidly expands its clean energy infrastructure. As the expansion period peaks, annual growth stabilises at an average rate of 3% through to 2050. Given the criticality of construction for accelerating decarbonisation action in Queensland, the industry delivers an economic dividend of $75 billion by 2050.

Further, emerging industries driving construction related activity can provide more sustainable employment pathways (compared to the more cyclical nature of commodity sectors). As the hydrogen industry matures, for example, construction occupations such as pipeline technicians can find ongoing work in the hydrogen industry through pipeline maintenance throughout the project lifetime to create job security.[22] As a result, the 75% by 2035 target helps the construction industry support an additional 33,000 jobs each year on average to 2050.

Clean energy and electrification powers industrial transformation, electrifies households and improves efficiency across the economy.

As Queensland moves towards its 75% emissions reduction target by 2035, the economic benefits of clean energy for industry and households are brought forward. The expansion of clean energy assets enables cheaper and earlier abatement across industries and encourages greater electrification in the economy.

With the full implementation of Queensland's Energy and Jobs Plan, Queensland takes advantage of its solar and wind resources, transforming the energy system to power Queensland with clean, reliable, and affordable energy.[23] Investment in clean energy outpaces investment in most other sectors of the economy, as the enabling infrastructure scales rapidly to meet 75% by 2035. In doing so, Queensland supports an additional 18,000 jobs each year on average in the clean energy sector to 2050.

As global economies phase out fossil fuels in the transition to net zero, the capabilities, supply chains and infrastructure currently utilised in conventional energy will need to be repurposed to support sustainable growth in low-emission industrial activity, such as critical mineral manufacturing. This will be supported by Queensland policies such as clean energy hubs, which work to capitalise on skilled workforces and existing infrastructure already established in regional Queensland.[24] While the conventional energy sector adjusts, a coordinated approach to transition supports the retention of workers within the wider energy industry.

Each year in Queensland, the new jobs added to the clean energy sector substantially offset jobs which transition away from conventional energy. For every job transition in conventional energy, 15 jobs are added each year in clean energy across Queensland to 2050.

Services remains the largest sector and employer across the state, decarbonising via abundant clean energy and enabling the transition of industrial activity on the path to net zero.

Services, whether financial or population-related (like health and education), can decarbonise early and efficiently via the significant investments in clean energy and broader electrification of the economy. This supports the majority of workers and activity in the Queensland economy as it reaches 75% by 2035.

Importantly, the services sector enables the broader transition to net zero. The finance sector, for example, is key to facilitating the reallocation of investment, as well as supporting actions that switch financial incentives away from emission-intensive activities.[25] Other professional and technical services and population services also greatly benefit from increased investment in industrial activity and growing exports. There is over $93 billion in additional investment across the services sector through to 2050.

This investment and increased demand particularly supports employment in Queensland's regions, where the greatest industrial transformations create the greatest need for supporting services, with 25,000 additional jobs supported annually, on average, in regional Queensland service industries out to 2050.

The services sector does not experience consistent growth over the full period to 2050. This is due to the flexibility of the sector, where the transferability of skills and shifting wages sees workers attracted into growing industries based on high demand for their services. The large and adaptable workforce in the services sector supports other Queensland industries to deliver their high growth outcomes. This results in a slight slowing of the services sector itself as labour flows to where it is most needed, such as clean energy or critical minerals mining, but enables higher growth for the Queensland economy as a whole.

Transport, freight, and logistics is a complex and global industry. The decarbonisation of transport is a critical enabler of wider economic growth, playing across both business and household transition to net zero.

As one of the largest emitters in Queensland's economy, currently representing around 16% of the State's total emissions[26], the transport industry undergoes a substantial technological and infrastructure transformation to reach net zero.

Early decarbonisation and electrification provide the opportunity for a co-ordinated, least-cost transition pathway under 75% by 2035 given the dependency of this sector on broader investments into alternative energy.

As a trade-reliant state, the decarbonisation of Queensland's air, freight and logistics transport sector is critical to the growth of the entire economy. Retained emissions intensity in this sector can act as a barrier to trade with decarbonising economies. Early emissions reduction in this sector can, however, safeguard Queensland's trade networks and retain the competitiveness of exports as global supply chains move towards net zero. The decarbonisation of this sector requires larger upfront investment given its current reliance on emissions-intensive fuels, with over 75% of additional investment into the sector occurring between 2030 and 2040. Such investment enables the industry to continue to grow at an average annual rate of 2% over the next 25 years, supporting Queensland's industrial activity and trade, while also decoupling the sector from fossil fuels.

Beyond trade, early transition within the air transport sector (for example, through the uptake of technologies like SAF) will be essential for sustaining tourism. While initially costly, early transition can improve longer-term economic performance, creating jobs in adjacent industries, such as SAF manufacturing.[27]

Regional Analysis

75% by 2035 grows regional Queensland economies

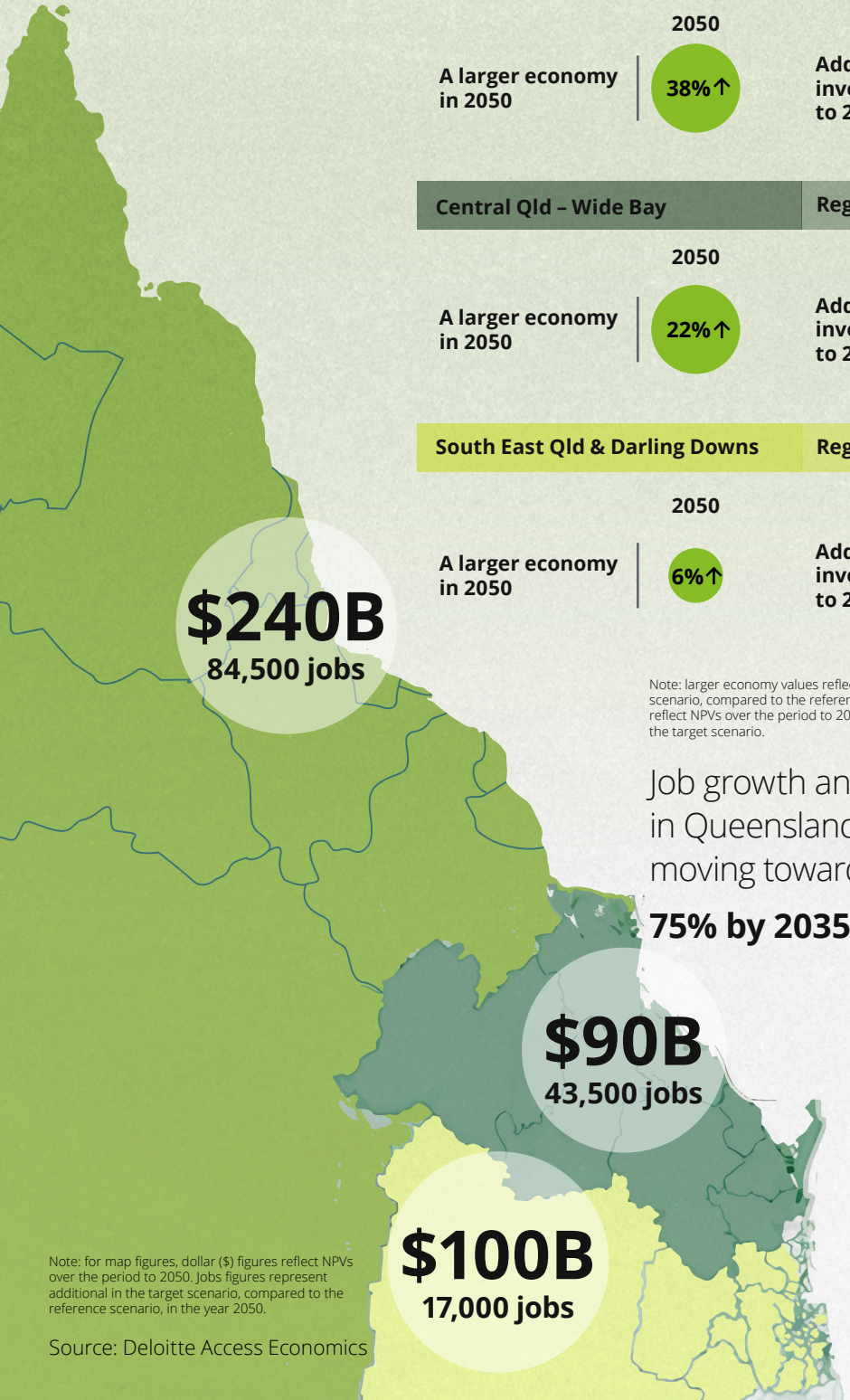
Figure 7: Regional economic results
Economic and employment impacts under the 75% by 2035 pathway to net zero

North & Outback Qld	Regional investment	Regional workforce
A larger economy in 2050: 2050 — 38%↑	Additional investment to 2050: 2050 — $134B	Workforce is **700k** workers in 2050, 20% larger than today

Central Qld – Wide Bay	Regional investment	Regional workforce
A larger economy in 2050: 2050 — 22%↑	Additional investment to 2050: 2050 — $84B	Workforce is **400k** workers in 2050, 27% larger than today

South East Qld & Darling Downs	Regional investment	Regional workforce
A larger economy in 2050: 2050 — 6%↑	Additional investment to 2050: 2050 — $52B	Workforce is **2.6M** workers in 2050, 40% larger than today

Note: larger economy values reflect the relative additional gross regional product in the target scenario, compared to the reference scenario, in the year 2050. The additional investment ($) figures reflect NPVs over the period to 2050. Regional workforce values reflect the size of workforce under the target scenario.



Job growth and regional economic development in Queensland depend on quickly, but carefully, moving towards net zero emissions.

75% by 2035 enables this.

Note: for map figures, dollar ($) figures reflect NPVs over the period to 2050. Jobs figures represent additional in the target scenario, compared to the reference scenario, in the year 2050.

Source: Deloitte Access Economics

North & Outback Queensland

Under 75% by 2035, there is a $240 billion economic opportunity and 84,500 new jobs added in 2050.

The North and Outback Queensland region includes the Queensland Outback SA4 and the northern SA4s including Mackay-Isaac-Whitsunday, Townsville, and Cairns. The regional boundary roughly aligns to the North and Far North REZs and captures the scaling of clean energy solutions in the region to deliver reliable and affordable energy to regional communities and industries.

Accelerated decarbonisation grows exports and low-emission industrial activity across the North Queensland economy

2035 target catalyses investment

There is a large expansion of clean energy, and hydrogen and utilities in North Queensland, enabled by investments outlined in the Queensland Energy and Jobs Plan (e.g., Copperstring 2032). The growth in clean energy and alternative fuels such as SAF lowers the cost of transition for hard-to-abate sectors such as transport.

Strong return on 2035 investment

From 2035, North Queensland has pivoted its economy such that it capitalises on the opportunities of clean energy. This allows the region to prosper, despite adjustments in harder-to-abate industries. North Queensland can leverage its natural endowments to become the state's primary producer of critical minerals, servicing growing foreign demand.

The economy is larger and more diverse by 2050

By 2050, North Queensland's economy will be powered by clean energy, produced in North and Outback Queensland, and delivered across the State. The region can also be a primary producer of essential resources in a net zero world – hydrogen and critical minerals. These sectors cement North Queensland as a key region to ensure Queensland's continued export resilience.

Historically a resource-intensive region, North and Outback Queensland has an economic base capable of pivoting towards high value-adding and high demand industries in a net zero world.

North and Outback Queensland undergoes an accelerated but coordinated economic transformation to decouple regional growth from fossil fuels and take advantage of the opportunities presented by global decarbonisation. This attracts an additional $134 billion in investment across all industries in the region. The rapid scale-up of clean energy infrastructure, including transmission and distribution, in the North and Far North REZs grows the **clean energy** sector, delivering $25 billion in industry output by 2050. This supports 6,600 additional jobs being added each year on average to the region's clean energy industry out to 2050.

North and Outback Queensland's natural endowment of **critical minerals** provides the region with a clear pathway for transition, leveraging existing infrastructure and skills to deliver an economic dividend of $87 billion in industry output, and supporting an additional 10,800 critical mineral jobs each year on average to 2050. As global economies phase out fossil fuels and transition, demand for thermal coal declines, however this decline is offset by growth in low-emission mining activity such as metallurgical coal and critical minerals and development of new clean industries such as hydrogen.

Metals manufacturing and **hydrogen and utilities** capitalise on co-location benefits with critical minerals extraction, supporting greater economic complexity and diversity, facilitating an industrial sector economic dividend of $23 billion by 2050.

What's at stake by failing to decarbonise further from today?

In the absence of policy support and investment to enable a smooth and coordinated transition, the region is unable to maintain competitiveness to meet foreign demand for low-emission key commodities needed to support the global transition to net zero. Those industries which have historically driven economic growth in the region cannot transform and are not replaced by high-demand industries like critical minerals, putting at risk the $240 billion in future economic growth potential by 2050.
If North Queensland doesn't reduce emissions intensity of exports, the region risks trade penalties imposed by those who are accelerating decarbonisation efforts. This puts at risk, on average, 1,300 less jobs in metallurgical coal each year on average to 2050 by not tackling fugitive emissions early.

Central Queensland – Wide Bay

Under 75% by 2035, there is a $90 billion economic opportunity and 43,500 new jobs added in 2050.

The Central Queensland – Wide Bay region includes the Central Queensland SA4 and Wide Bay SA4. This regional boundary roughly aligns to the Central Regional Energy Zone (REZ), which captures the scaling of clean energy solutions in the region to assist households and industry to decarbonise efficiently.

Bringing forward significant industrial investment creates a larger and more diverse Central Queensland economy

A 75% target by 2035 signals to industry to scale investment, adopt new technologies, attract new workers, and support new skill development. Global supply chains recognise Central Queensland as an investment destination and industrial activity that a net zero world needs.

From 2035, Central Queensland's economy is on average 1.8% larger each year to 2050. This growth is driven by green hydrogen industry development and supporting services, agricultural exports, and low-emission metallurgical coal production under the 75% target.

When the economy is net zero in 2050, it is 22% larger compared to the reference case and has effectively transformed to be a competitive and thriving regional economic powerhouse. There is an additional 43,500 jobs added to the workforce and communities are set up for sustainable long-term growth in a net zero world.

Investment in new industrial capability diversifies the Central Queensland – Wide Bay economy and prepares it for future growth and export resilience.

Over the modelling period, a total of $84 billion of private and public investment flows into the region to rapidly reduce emissions, scale up emerging industries and improve productivity. Over a third ($33 billion) of this is injected into **clean energy, hydrogen, and utilities sectors** to build out the Central REZ and transform region's energy mix. Scaling up the region's clean energy capacity returns an economic dividend of $38 billion in industry output by 2050 and supports, on average, an additional 9,700 jobs each year.

The rapid development of the REZ also stimulates a significant uplift in **construction** activity. Supporting the rapid deployment of clean energy and hydrogen projects to meet 75% by 2035, construction activity peaks in 2036, and supports an additional annual average of 10,600 construction jobs to 2050. By 2050, the 75% by 2035 target could generate an additional $20 billion of economic value from the regional construction sector.

The expansion of the REZ supports the electrification and diversification of the regions' industrial base, making manufacturing and critical mineral processing more competitive to meet growing global demand for low-emission energy and minerals, while adding value to Central Queensland – Wide Bay's economy. This **industrial transformation** returns an economic dividend of $8 billion in industry output by 2050. Higher wages in hydrogen, clean energy, and related services (for example), alongside increased technological adoption, sees jobs transition away from the region's industrial and agriculture and land sectors and into these new industries.

Early investment in abatement technologies enables the **agriculture and land sector** to grow, while rapidly reducing its hard-to-abate emissions. Early abatement of the sector has allowed it to gain global competitiveness, growing at average annual rate of almost 4% every year from an accelerated transition to net zero.

What's at stake by failing to decarbonise further from today?

In the absence of coordinated investment and policy to transform and replace industries that have historically been at the centre of Central Queensland – Wide Bay's economic growth, the region risks losing $90 billion in future economic growth over the next 25 years.
A failure to rapidly reduce emissions across the region's industries puts at risk investment,

a competitive, export-oriented green industrial base, and the stability of its workforce. This could mean that, each year on average to 2050, there are 2,000 fewer jobs in critical minerals in the region. And failing to tackle fugitive emissions early risks 1,600 fewer jobs annually, on average, in metallurgical coal due to lost global competitiveness, for example.

South East Queensland & Darling Downs

Under 75% by 2035, there is a $100 billion economic opportunity and 17,000 new jobs added in 2050.

The South East Queensland and Darling Downs region includes all other Queensland SA4s, including Brisbane, Ipswich, Logan, Gold Coast, Sunshine Coast, Moreton Bay, Toowoomba and the Darling Downs.

Faster and earlier emissions reduction supports households and businesses to transition to net zero

South East Queensland & Darling Downs (SEQ) electrifies, which drives sectoral growth for clean energy and construction, to support the development of clean energy infrastructure, in Queensland's most populated region. This complements steady services demand, which supports structural adjustment across the resources and industry sector.

The state-wide dividend of early abatement is supported by SEQ's services industry, which is key to transformation agendas in industries like green hydrogen, mineral manufacturing, and clean energy. Coupled with ongoing expansion of SEQ's clean energy and construction sectors, this drives above-trend growth in the region from 2035-50.

Energy sector expansion supports a large industry base in SEQ, while the region's core services are critical for the state's economic transformation. By 2050, the resilience and expertise built through early abatement provides an economic dividend of $100 billion by 2050, on the path of 75% by 2035.

South East Queensland & Darling Downs grows through electrification, and remains a hub for knowledge and business operations to support emerging industries

Under 75% by 2035, over 80% of total investment goes to North and Outback Queensland and Central Queensland, with SEQ attracting $52 billion in additional investment out to 2050. The investment in SEQ primarily goes into clean energy, resources, and services – all industries and activities which are integrated into the regional industrial sectors which have a more significant transformation task on the path to net zero.

SEQ undergoes large-scale energy switching and electrification across households, and businesses. This leads to large growth in clean energy, especially electricity transmission and distribution, as SEQ delivers the infrastructure required to transmit clean energy wherever it is needed. The **clean energy and electricity transmission** sectors supports an additional 7,500 jobs in SEQ annually, on average, each year to 2050. This clean energy activity delivers an economic dividend of $39 billion to the SEQ economy by 2050.

As a centre for professionals, such as engineers and business operations workers, SEQ also benefits greatly from growth in the Queensland critical minerals industry. While little extraction occurs in the area, SEQ remains a hub for head offices and a talent centre. As a result, critical minerals experiences growth and provides an economic dividend of $63 billion by 2050 in SEQ, supporting an additional 4,900 jobs each year on average.

Significant investment in and scaling up of new industries in regional Queensland, stimulates **construction** sector activity to support the development of new infrastructure. This generates $24 billion from the sector's growth and supports an additional average of 9,500 job per year to 2050.

What's at stake by failing to decarbonise further from today?

In the absence of coordinated policy support to meet 75% by 2035, Queensland is exposed to trade penalties and higher capital risk premiums which hit households and businesses. This places tremendous strain on the entire Queensland economy and makes investing in Queensland less attractive. SEQ could potentially miss out on $100 billion in economic growth by 2050 due to this.

This affects carbon-intensive industries and impacts those industries that would otherwise grow on a well-managed path to net zero by 2050. There would be, on average, 1,300 fewer jobs in clean energy in SEQ each year out to 2050, for example.

The affordability of 75% by 2035 to Queensland households and businesses

Measuring household and business impacts of transition to net zero.

To establish a view of how Queenslanders and businesses could be directly impacted by changes in the economy under 75% by 2035, Deloitte Access Economics constructed two indexes to measure transition affordability. Indexes for household standard of living and business transition affordability have been developed using Principal Component Analysis, based on modelled outputs from D.Climate. Appendix A provides the technical method.

This approach produces a view of complex changes in incomes and prices from the transition to net zero to 2050. Index results are not a percentage change in individual macroeconomic variables (such as how inflation is measured).

Figure 8: Household and business index results
Indexed measure of affordability of 75% by 2035 to Queensland households and businesses

Household standard of living index	Average to net zero **2025 to 2050**
South-East Queensland & Darling Downs	Improvement
Central Queensland – Wide Bay	Significant improvement
North & Outback Queensland	Significant improvement
Business decarbonisation affordability index	**2025 to 2050**
South-East Queensland & Darling Downs	Improvement
Central Queensland – Wide Bay	Improvement
North & Outback Queensland	Improvement

What does each index show?
Each index measures the percentage change (%) in Deloitte's modelled scenarios using the indexed variables detailed in Appendix A. It compares "75% by 2035" to the reference scenario.

What matters for households?
The household index measures how economic changes to net zero impacts standards of living by considering incomes, employment and regional economic outcomes.

What matters for business?
The business index measures how economic changes to net zero impacts affordability of all energy sources, such as electricity and direct fuels. It measures affordability of changes needed to reduce emissions intensity of production.

How index change is measured and defined

- Over 10% improvement
- 1% to 10% improvement
- Absolute impact of <1% Neutral impact
- -10% to -1% reduction
- Over -10% reduction

Source: Deloitte Access Economics

Higher standards of living and lower household costs for Queenslanders under 75% by 2035.

Better economic outcomes and standards of living are highly dependent on stable job growth and wages. As the global economy and Queensland industry accelerate emissions reductions, they will need to tap into the skills, knowledge, and experience of the workforce to deliver. The transition to net zero won't happen to workers, it will happen because of them.

A just transition is not about focusing on the total number of future jobs that will adjust or be created. It is about the future skills needed, and how a well-planned and delivered transition pathway can harness the full potential for workers to use them in a world of emerging economic opportunity.

The 75% target by 2035 presents significant employment growth opportunities and growing wages in emerging low-emission industries across Queensland.

Regional Queensland is incredibly attractive for new investment and job opportunities as the low-emission industrial transformation plays outs to 2050. High demand for workers in emerging industries like hydrogen in Gladstone and critical mineral mining in North Queensland creates high-paying, long-term employment growth. Worker demand also emerges from the significant ramp-up in construction activity from today to build low-emission infrastructure and energy sources.

These impacts mean that the 75% by 2035 path results in moderate to significant improvements in household standards of living for every Queensland region. Out to 2030, all households are better off, or have a neutral impact, indicating stability despite significant economic changes as industry and government coordinate to meet the 75% by 2035 target.

A net zero Queensland economy reduces business cost pressures and transition affordability improves under 75% by 2035.

The affordability of technological change needed for business decarbonisation depends on trade cooperation, coordinated government policy, and regulatory settings that encourage business to innovate. The 75% by 2035 economy offers Queensland businesses and their supply chains the policy settings needed to achieve these changes.

In modelling the 75% by 2035 economy, industry growth, increasing export values and high demand for new workers are all signals the transition to net zero is being delivered by large scale low-emission technologies and investments.

Significant early investments to decarbonise fugitive emissions in mining improve the sector's long-term prospects in the face of rapidly changing foreign demand (both increasing (e.g. critical minerals) and decreasing (e.g. metallurgical coal)). This can be seen in North and Outback Queensland, where large, front-loaded capital investments to reduce fugitive emissions result in a moderate reduction in business affordability to 2030, but lead to long-term improvements by 2050.

For Central Queensland – Wide Bay, rapidly growing investments and activity in hydrogen and supporting clean energy industries, for example, sees business cost pressures reduced early. As this industry activity peaks and normalises to steady growth, long term business costs continue to improve and the low-emission transition results in reduced cost pressures for business from today to 2050.

Businesses in South East Queensland and the Darling Downs benefit early, and consistently, from renewable energy changes delivered under the Queensland Energy and Jobs Plan. This supports a stable improvement in business cost pressures as the broader Queensland economy transforms to become net zero.

Today's workers have valuable skills and experiences that are assets to both the economy and to their own success as the economy transitions. A net zero future gives workers a chance to use their skills in new ways, to build emerging industries, and to explore new occupations altogether.

Appendix A: Modelling detail

D.Climate model

D.Climate, is Deloitte Access Economics' in-house climate-integrated computable general equilibrium (CGE) and integrated assessment model (IAM). It combines emissions, abatement, and climate damages with an economic model to represent the implications of the latest climate science and climate policy for economic activity (Figure A1 and A2). In doing so, this model can capture the sub-national, national and global picture of climate change policy, accounting for global trends in emissions reduction, technological development and changes in public policy to reflect the physical and transitional costs associated with different abatement pathways.

Figure A1: D.Climate modelling framework

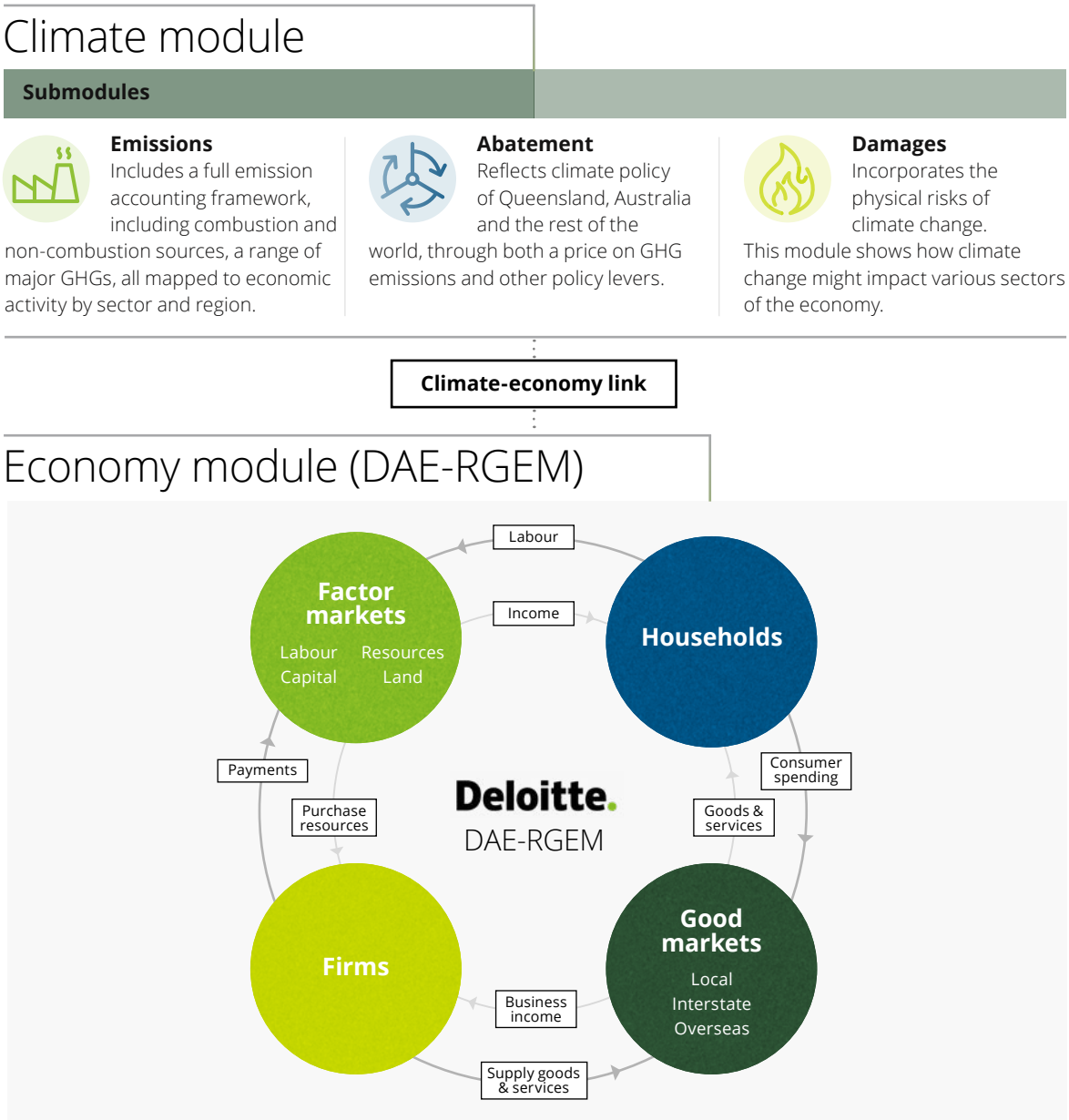
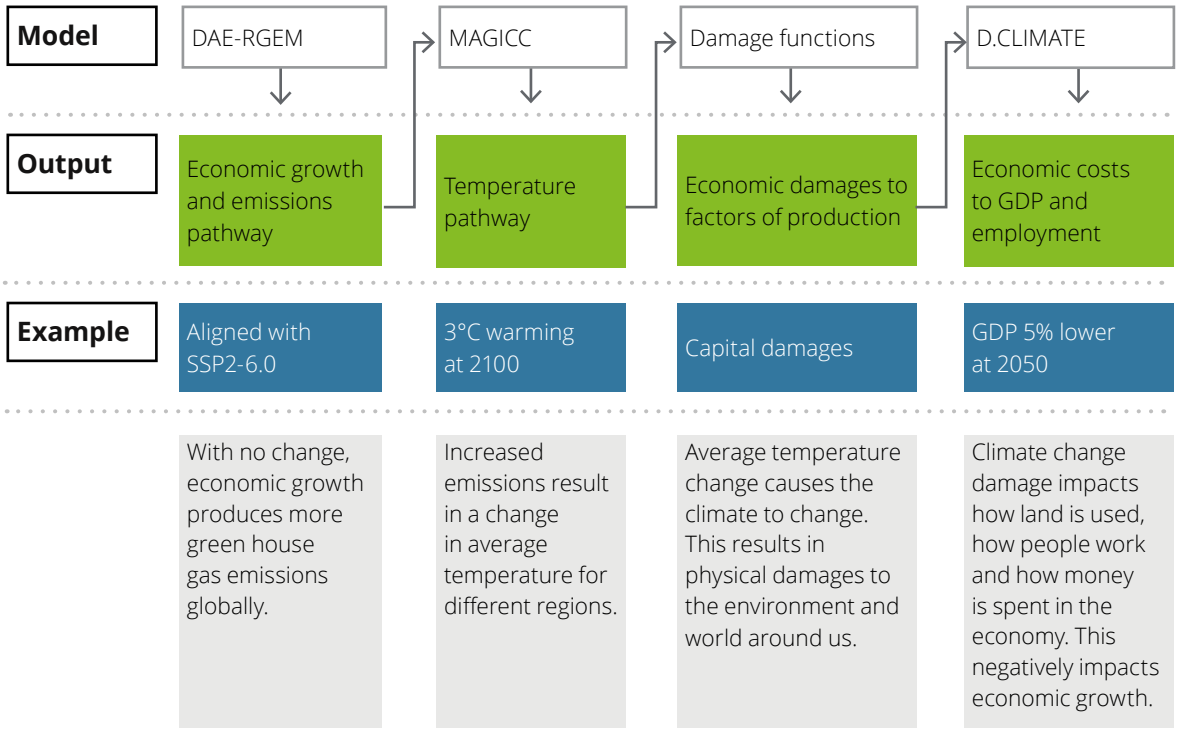


Figure A2: D.Climate climate-economy link



Source: Deloitte Access Economics

Results from D.Climate provide a 'top down' order-of-magnitude estimate of the impact of climate change on economic outcomes such as gross domestic product (GDP), employment, industry value added (at the industry and regional level), investment and trade. These outputs can be used to provide insights into which industries, jobs and economic activity have the most to lose—or gain—from different decarbonisation trajectories. Further insights involve which local economies are impacted the most by the choices being made, the costs and benefits of different options for decarbonisation, and by how much any degree of climate change will impact the economy and organisations. To this end, the core function of D.Climate is to provide an economic analysis tool that can be used to answer a variety of questions relating to the economic impacts of a changing climate and evolving policy landscape.

Importantly, results from D.Climate should not be interpreted as forecasts or 'most likely' estimates of climate-change or net zero policy impacts. The scenario analysis and modelling framework instead provides a consistent lens through which to understand the economic difference between possible future worlds, enabling conclusions to be drawn about trade-offs and the direction of change in industries, and regional economic outcomes.

Further information on D.Climate's framework and methodology can be found online as part of a detailed, publicly available technical appendix for previous research.

Regional and Industry definitions

D.Climate is a global model and can be tailored to a specified regional concordance in line with the GTAP database. Three Queensland subregions (South-East, Central and North Queensland) have been modelled (Table A1), in addition to other Australian states and territories, the Asia Pacific and the rest of the world.

Table A1: Regional definitions

Modelled sub-region	SA4 Breakdown
South East Queensland & Darling Downs	Brisbane – East, Brisbane – North, Brisbane – South, Brisbane – West, Brisbane Inner City, Darling Downs – Maranoa, Gold Coast, Ipswich, Logan – Beaudesert, Moreton Bay – North, Moreton Bay – South, Sunshine Coast, Toowoomba
Central Queensland – Wide Bay	Central Queensland, Wide Bay
North & Outback Queensland	Cairns, Mackay – Isaac – Whitsunday, Townsville, Queensland – Outback

The industries reported on in this report are defined in Table A2 below. These industry aggregations are based on specified sectoral concordance in line with the GTAP database. A specific effort was made to distinguish two non-GTAP sectors (hydrogen and critical minerals mining) to aid in the representation of the transition to net zero. In addition, metallurgical coal was split out from other coal mining in the model.

Table A2: Industry definitions

Industry	Definition
Agriculture and land	Agriculture, forestry and fisheries and land-use sector
Coal mining	Thermal and metallurgical coal mining
Critical minerals and other mining	Critical minerals mining and all other mining and extraction (e.g., metal ores)
Conventional resources	Oil and gas extraction, petroleum refinery and gas manufacture
Hydrogen and utilities	Hydrogen and water services
Critical mineral and other resource manufacturing	Manufacture of non-metallic mineral products (e.g., cement) and ferrous and non-ferrous metals manufacturing
Manufacturing	Heavy manufacturing, chemical manufacturing, food and light materials manufacturing
Clean energy	Zero-emission electricity (e.g., renewables)
Conventional energy	Fossil fuel-based electricity (e.g., coal-fired power)
Electricity transmission and distribution	Electricity transmission and distribution
Services	Public (e.g., defence, health, education) services, private services and wholesale and retail trade
Transport	Air, freight + logistics transport
Households (emissions only)	Household + personal vehicle emissions

Scenario descriptions

Several key variables and assumptions describe the scenarios analysed in this study (see Figure 2 in the report). Starting with Queensland and Australia, these emissions and electricity mix settings are central to interpreting the results.

Table A3: Scenario descriptions

	Queensland		National (rest of Australia)	
	Reference Scenario	**Target: 75% by 2035**	**Reference Scenario**	**Target: 75% by 2035**
Emissions reduction (% reduction on 2005 levels)	Queensland takes no further action to decarbonise from today (2024) and does not keep up with the rest of the world to meet net zero.[vii] Queensland's net emissions are • 37% below 2005 levels in 2030 • 47% below 2005 levels in 2035 • 54% below 2005 levels in 2050.	Queensland reduces emissions in line with DCCEEW emissions projections to 2030, which includes the Safeguard Mechanism. Queensland sets an emissions reduction target for 75% by 2035. Queensland's net emissions are • 42% below 2005 levels in 2030 • 75% below 2005 levels in 2035 • Net zero by 2050.	National DCCEEW baseline emissions projection to 2030, which includes the Safeguard Mechanism. Queensland's higher emissions means the rest of Australia has to work harder to reach net zero. Australia's net emissions are • 37% below 2005 levels in 2030 • Net zero by 2050.	National emissions decline more rapidly in comparison to the Reference Scenario. Australia achieves its 2030 interim emissions reduction target. Australia's net emissions are • 43% below 2005 in 2030 • Net zero emissions by 2050.
Negative emissions in 2050[viii]	By 2050, negative emissions are approximately -24 MtCO2e, defined and benchmarked out of model.[ix]		By 2050, negative emissions are approximately -158 MtCO2e, defined and benchmarked out of model.	
Electricity mix (% of total final electricity demand)	Queensland's electricity grid decarbonises in the baseline, with renewable electricity dominating the total share of electricity sector output by 2050. Renewable electricity represents 44% of total electricity supplied in Queensland by 2030.	Queensland rapidly decarbonises its electricity mix achieving, 73% renewable electricity by 2030, and by 2040, renewable electricity represents the vast majority of the electricity supplied in Queensland. Shares of renewable electricity generation benchmark to the Queensland Energy and Jobs Plan, in addition to AEMO's 2024 Integrated System Plan – Step Change Scenario. There is a higher share of renewable electricity in the economy in the Target 75% by 2035 scenario due to expanded generation for green hydrogen.	In line with DCCEEW's baseline business as usual scenario, renewables generation in the rest of Australia represent 73% of the total electricity produced in the NEM by 2030. Australia does not meet its 2030 target 82% by 2030 target and decarbonises the electricity sector rapidly achieve net zero emissions by 2050 (97% renewable electricity).	By 2030, renewable energies represent 73% of Australia's electricity mix. Australia electrifies earlier, with renewables representing 99% of the total electricity produced in the NEM by 2040.

[vii] Declines in line with DCCEEW baseline emissions projection to 2030. After 2030, Queensland's emissions decline at 2023-2035 projected sectoral rates, carried out to 2050.
[viii] These estimates include the negative contribution of forest land and an assumed level of negative emissions technology (which could include carbon capture, utilisation and storage among other technologies).
[ix] Queensland's share of Australia's negative emissions potential at 2050 is informed both by current sources for negative emissions today (e.g., from forest land) and modelled pathways for development of other technologies in similar studies (e.g., Net Zero Australia).

Target scenario industry-level shocks

Several Queensland-specific, industry-level shocks were implemented to reflect the policy intent of the 75% by 2035 target and supporting policy initiatives.

Table A4: Summary of key assumptions in the Target Scenario – Queensland

Industries	Summary of Queensland assumption / benchmark	Sources and information used to develop assumptions
Agriculture and land	The 2035 target spurs investment in R&D today eventually leading to breakthroughs in the emissions intensity of the livestock sector. Methane emissions intensity of livestock falls over the period 2036 to 2050.	• Queensland's low emissions agriculture roadmap, 2022-2032 • Global Methane Pledge • Environmental Defense Fund and Deloitte, Pathways to Net Zero: The Innovation Imperative
Critical minerals	Foreign demand for Queensland's critical minerals grows, driving increasing the value of exports and investment in this sector (endogenously captured). Public and private sector investment in critical minerals is also assumed to increase between 2025 to 2040.	• Queensland's Resources Industry Development Plan • Queensland's Critical Minerals Strategy • Australia's Critical Minerals Strategy, 2023-2030 • Australian Government Critical Minerals Facility • IEA Critical Minerals Market Review 2023
Hydrogen	Queensland's green hydrogen exports grow rapidly over the period from 2024-2030 and before stabilising from 2031 to 2050.	• Queensland Department of Energy and Climate Change information and AEMO's ISP scenarios • Queensland's Hydrogen Industry Strategy 2019-2024
Manufacturing	Foreign demand for clean manufacturing products increases between 2024 and 2035. Additional government investment in this sector supports decarbonisation.	• Queensland Manufacturing Strategy including the Advanced Manufacturing 10-year Roadmap and Action Plan • Queensland new-industry development strategy • Queensland Battery Industry Strategy 2024-2029 • The economic potential of Australia's critical minerals and energy transition minerals
Coal mining	Average annual reduction in emissions intensity of fugitive emissions from coal mining (metallurgical and thermal coal).	• Low Emissions Investment Partnerships (LEIP) program • Safeguard Mechanism Rule and Facility Reported Emissions • Coal Industry Review Statistical Tables • Global Methane Pledge
Transport	D.Climate model results for transport emissions reductions align to independent modelling (e.g., AEMO ISP assumptions).	• Queensland's Zero Emissions Vehicle Strategy 2022-2030 • Queensland's Zero Emission Vehicle Action Plan 2022-2024 • Australia's National Electric Vehicle Strategy • AEMO's 2023-24 ISP Electric Vehicle Workbook
Worker support measure	For hard-to-abate industries – such as manufacturing and agriculture – that experience capital deepening during transition (i.e., replacing emissions intensive machinery which may require less workers) it is anticipated that worker support measures would be provided based on current policy settings such as, for example, the Job Security Guarantee and Fund.	• Job Security Guarantee and Fund

Global assumptions

Several global assumptions shape Queensland and Australia's economic outcomes. They are consistent between the reference and target scenarios.

Table A5: Summary of key assumptions under Reference and Target Scenarios – Global

Key Parameter	Assumptions	Source
Emissions	Global greenhouse gas emissions rapidly reduce to keep warming 'well below 2°C' (aligned to SSP1-1.9 IPCC scenario).	IPCC Sixth Assessment Report Climate Resources as per Meinshausen, M. et. Al.[28]
Technology learning rates	Average annual reductions in $/Kwh in capital costs for renewables (approx. 1.25 % pa between 2030 and 2050).	IEA Net zero by 2050[29]
Hydrogen demand	Total demand for hydrogen increases from ~100 Mt per year to ~500 Mt per year by 2050.	

In response to Queensland's policy settings in the **Reference Scenario**, the rest of the world is assumed to impose trade penalties and capital risk premiums. These are outlined in Table A6.

Table A6: Summary of key assumptions – Reference Scenario

Shock	Industries	Assumptions	Key sources and analytical approaches
Trade penalty	Hard-to-abate industries	• Trade penalties are uniformly imposed by the rest of the world: Reflecting the scenario definition that economies are decarbonising per SSP1-1.9 would imply all economies value GHG emissions (either directly or indirectly via regulation and subsidies to low-emission goods etc).	• Climate Council - The Economic Costs of Australia's Climate Inaction • World Bank weighted mean tariff rates • Deloitte Access Economics analysis of US' Inflation Reduction Act, EU's Green Deal Industrial Plan, other 'green' local content requirements • NAB, Deloitte Access Economics – All Systems Go 2023 • Deloitte Access Economics Study on Non-Tariff Measures Affecting Trade in Goods Reducing Greenhouse Gas Emissions
Capital risk premium	Economy-wide	• Increased financing costs for industries and households due to higher exposure to climate risks and the transition process. Captured through increased cost of capital and risk premiums.	DCCEEW, Australia's long term emissions reduction plan

Sensitivity to discount rates

Although the Australian and Queensland Governments recommend a central discount rate of 7% for cost benefit and policy analysis, the Guidance outlines that a different discount rate can be used "where there is a research-related reason."

Deloitte Access Economics utilises a 2% discount rate for economic analysis pertaining to the impacts of climate change. A lower discount rate recognises the long-term impacts of climate change and the role of action (or inaction) today and its impact on the wellbeing of future generations.

This rate also reflects a consistent view on social discounting in climate change economic analysis, based on the results of a survey of economists in the American Economic Journal: Economic Policy (the sample contains over 200 academics who are defined as experts on social discounting by virtue of their publications) which indicates that most favour a low discount rate, with more than three-quarters arguing for a median discount rate of 2%. More recently, Bauer and Rudebusch (2023) have analysed trends in interest rates in the bond market to posit that lower interest rates since 1990's also provide a rationale to utilise lower a social discount rate in climate policy analysis.[30] Their analysis suggests real discount rates should range between 0.5% and 2%. The US Government, for the first time in 20 years, has also recently updated its guidance to a 2% discount rate, and suggested a lower discount rate for analysis longer than 30 years.[31] This discount rate is utilised in their calculation of the social cost of carbon.[32]

Nevertheless the sensitivity of headline results to a range of discount rates is presented below.

Table A7: Sensitivities to discount rates

	Discount Rate		
Queensland GSP ($millions)	2%	4%	7%
2024-2050	$430,361	$302,608	$184,887
2024-2034	$54,703	$46,491	$36,786
2035-2050	$375,658	$256,117	$148,101

Source: Deloitte Access Economics estimates.

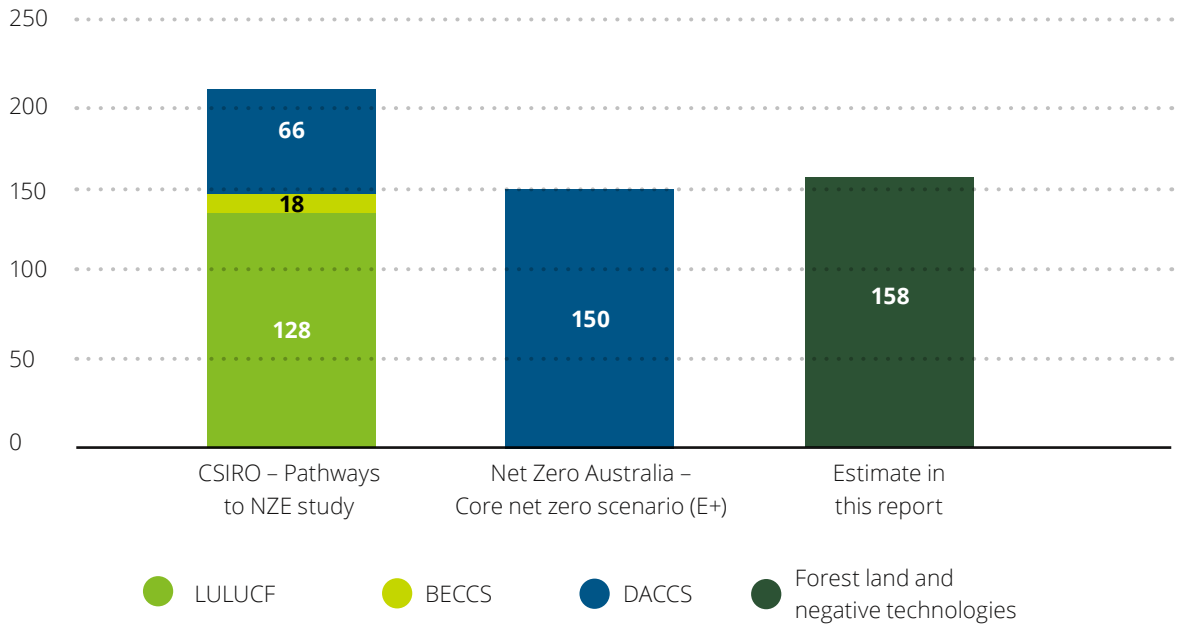
Limitations and notes on interpretation

The particular scenario definitions and focus of this analysis mean that results may not be directly comparable to previous studies highlighted above:

- **Decarbonisation in the rest of Australia and rest of the world is kept constant** across all scenarios so the model does not show the economic benefits to Queensland from reduced physical impacts of warming from additional emissions reduction. This modelling is based on a set of specific actions rather than a broad analysis of action versus inaction on climate change and as such is not comparable with previous Deloitte Access Economics analysis.[33] At the same time, Australia's high-risk exposure to climate change impacts also increases mitigation and adaptation costs. Emission-intensive industries, such as agriculture, manufacturing and mining, typically experience a higher compounding cost of physical climate damages which is relatively larger closer to 2050 as the climate increasingly changes. Concurrently, these industries experience higher transition impacts due to their emissions. Noting, earlier abatement in these industries bring forward transition benefits and could support increased adaptation in later years to physical climate risks. That is, reduced transition impacts creating more capacity to adapt.
- **Duration of analysis:** Benefits may be higher if modelling were extended beyond 2050. The transition impacts peak and decline, meaning new green industries formed as part of the transition continue to mature post-2050 in a net zero economy. The avoided physical impacts of climate change will also continue to benefit Queensland long after 2050.

- **Wider socio-economic impacts and distributional impacts:** Queensland's emissions reductions may drive several wider socio-economic impacts, such as improving environmental (e.g., air pollution), health and social outcomes. Economic models, such as D.Climate, are designed to analyse production, trade and employment outcomes that take place in markets. Such models do not necessarily capture broader impacts on welfare.
- **Negative emissions:** result from technologies that capture or remove carbon dioxide and either use or store it. Storage may be biological (in vegetation and soils, see previous section), geological (such as underground storage in oil and gas reservoirs), and in mineral form (such as through mineral carbonation, which accelerates weathering of rocks to sequester carbon dioxide). There is significant uncertainty around the future development of negative emissions technologies, with many today on a path to commercialisation.[34] Based on Deloitte Access Economics' benchmarking of similar studies and views on Australia's negative emissions technology potential, the following benchmarking confirms that the 75% by 2035 negative emissions assumption for Australia is a conservative one for 2050 (Chart A1).

Chart A1: Estimates of Australia's negative emissions in 2050, MtCO2e



Source: Deloitte Access Economics estimate.[35]

Transition impact index

D.Climate model results are accompanied by two separate indexes to provide insight into the costs of transition to households and businesses. These indexes – the household standard of living index and the business energy affordability index – are weighted combinations of D.Climate output variables, as detailed below. Scores for each of these indexes are produced for each transition scenario, region and year.

Table A8: Summary of Transition Impact indices

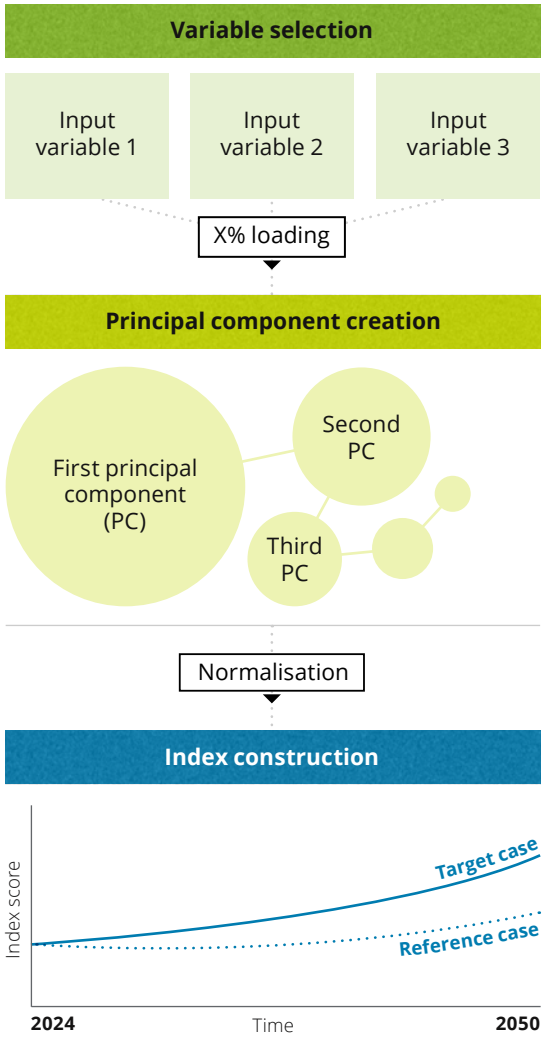
Index	Description	Input variables from D.Climate
Household standard of living	Measures changes in the economic resources that households have available to support their material living conditions. Variable selection has been informed by economic wellbeing frameworks developed by the Australian Bureau of Statistics (ABS) and OECD, which highlight factors related to employment, income, wealth, cost stability, and consumption as integral to maintaining a strong economic base to support high standards of living.[36]	Employment rate, average real wage, regional income per capita, household consumption, household general consumer price inflation.
Business decarbonisation affordability	Reflects the ability of businesses to manage energy cost stresses under transition scenarios. It is expected that transition policies cause inflation in business electricity and other fuels prices, which can place stress on energy affordability, however this may be countered by a reduction in emissions intensity, as businesses adapt to energy price shocks through being less energy-intensive in output.[37]	Business retail electricity price inflation, business retail fuels price inflation, business emissions intensity (emissions per unit of output).

Source: Deloitte Access Economics

As variables captured within the indexes are restricted to what is produced by D.Climate, primarily income and price variables, other factors such as social, distributional, and wealth factors cannot be included. As such, the scope of these indexes may differ to other external definitions. Further, correlation matrix analysis has informed variable selection process, with highly correlated variables being removed to prevent a skew in the index.[38]

Weightings of each D.Climate variable to the transition impact indexes are produced through a Principal Component Analysis (PCA) approach. This method assesses relationships between the input variables and combines them into a set of uncorrelated variables (principal components), with the first principal component explaining the greatest proportion of variation.[39] Each index is constructed out of the relative loadings of each input variable to the first principal component. The PCA approach to index construction employed is analogous to that used by the ABS for its Socio-Economic Indexes for Areas.[40] The final produced indexes are normalised to a mean of 100 and a standard deviation of 15.

Figure A3: Indices framework



Source: Deloitte Access Economics

Index scores correspond to the household standard of living or business decarbonisation affordability of a given scenario/region/year combination relative to other scenarios and regions, with higher index scores reflecting improvement in these outcomes. As with all indexes constructed using PCA, results (e.g., 'percentage change over reference case') cannot be interpreted directly, however reflect a degree of improvement or reduction over the reference case.[41] For example, a 5% increase in the household standard of living index does not imply 5% higher standard of living. However, a 5% increase can be interpreted as a greater increase than a 2% increase.

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