Queensland's Renewable Future

Investment, jobs and skills

Executive Summary

CSQ | STRONGER FUTURES IN CONSTRUCTION

August 2022

About the report

Queensland's Renewable Future is a study by Construction Skills Queensland (CSQ), drawing on exclusive CSIRO modelling, to understand the full implications of Queensland's renewable energy transition for the construction industry and its workforce.

The report models the scale of likely investment under three different scenarios. Each scenario corresponds to a different set of assumptions about the timing and composition of Queensland's pipeline of renewable investment to 2050.

As an objective and apolitical industry body, CSQ does not have a view on the 'right' path for Queensland's renewables transition. Our role is simply to observe the direction of travel on the ground so that we can unpack what it means for the construction industry, its workforce and their skills.

CSQ also does not attach probabilities to the occurrence of particular scenarios, given the significant uncertainties associated with a multi-decade forecast horizon.

The scenarios are not exhaustive of all possible development paths. They represent a range of realistic outcomes given what is currently known about energy markets, policy settings and the state of technology. Material changes in any of these domains may see other scenarios emerge as more relevant.

This executive summary is a selection of key charts and analysis from the Full Report. Additional insights and analysis are available on request. To enquire, please contact the team at research@csq.org.au.

● Countries with net zero policies

"Net zero commitments now encompass over 96% of global CO_2 emissions."

The global shift: from pledges to delivery

Climate change has triggered a global pivot to renewable energy that is progressing faster than anticipated.

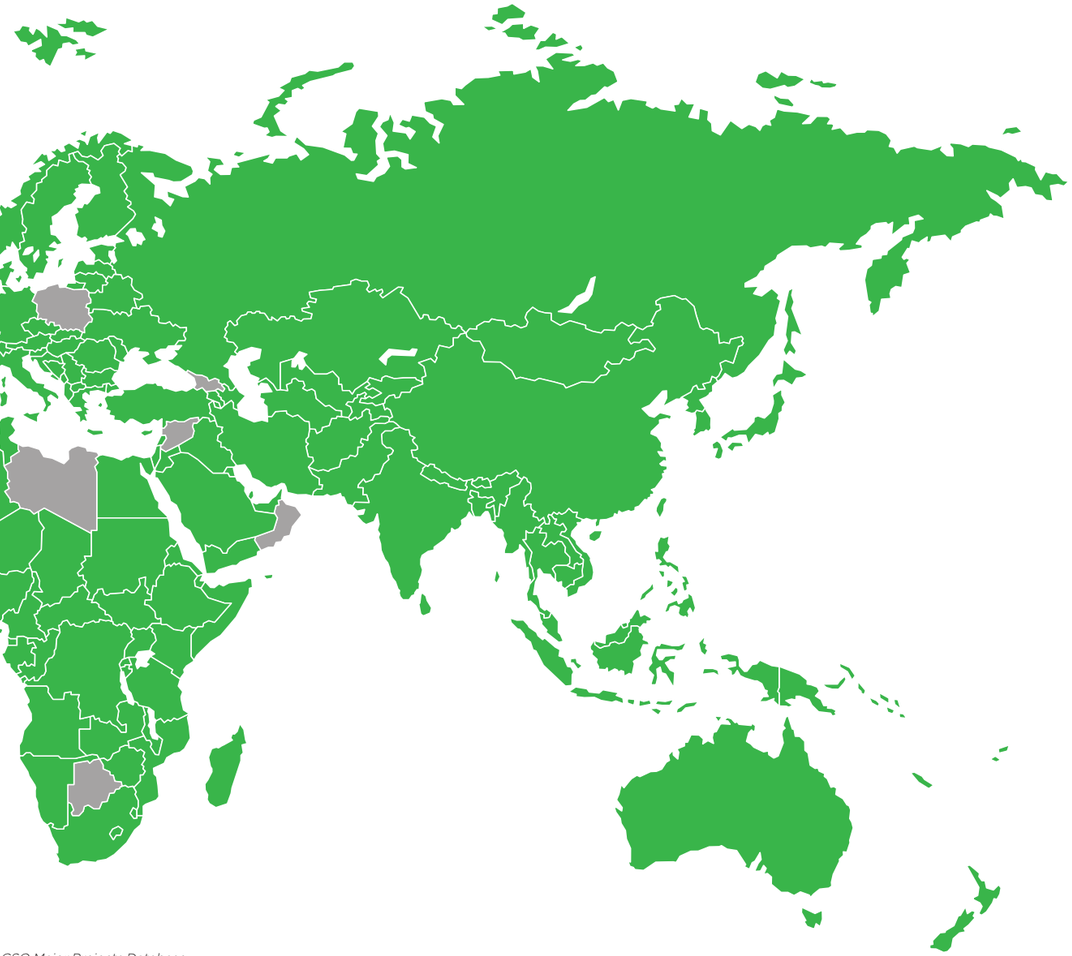
Nations are galvanising around the net zero ambition. Net zero commitments now encompass over 96% of current global CO_2 emissions. For its part, Queensland announced a target of net zero emissions by 2050 in 2017, with interim goals of a 30% reduction in emissions and 50% renewable energy penetration by 2030.

It is clear the renewables transition is no longer a 'what if' conversation. The trend is established and underway across the developed world and 20% of Queensland's major construction pipeline is now in renewables-related infrastructure – up from only 5% a few years ago.[i]

The policy discourse has also shifted materially, both in Australia and overseas. The emphasis on green hydrogen is a particularly notable policy development, with more than 30 nations releasing a hydrogen strategy in the last two years alone.

It is also clear that the transition will not be brief nor will it be trivial. It represents nothing less than a fundamental economic change, with significant implications for industries and workers – particularly construction.

Few places will experience this shift more acutely than Queensland. Queensland currently accounts for nearly a third of Australia's total emissions and has the lowest proportion of renewable power penetration. Yet it holds world-leading comparative advantages in renewables. This means Queensland is poised to play an outsized role in the coming renewables transition.



[i] CSQ Major Projects Database

Electricity + hydrogen = net zero

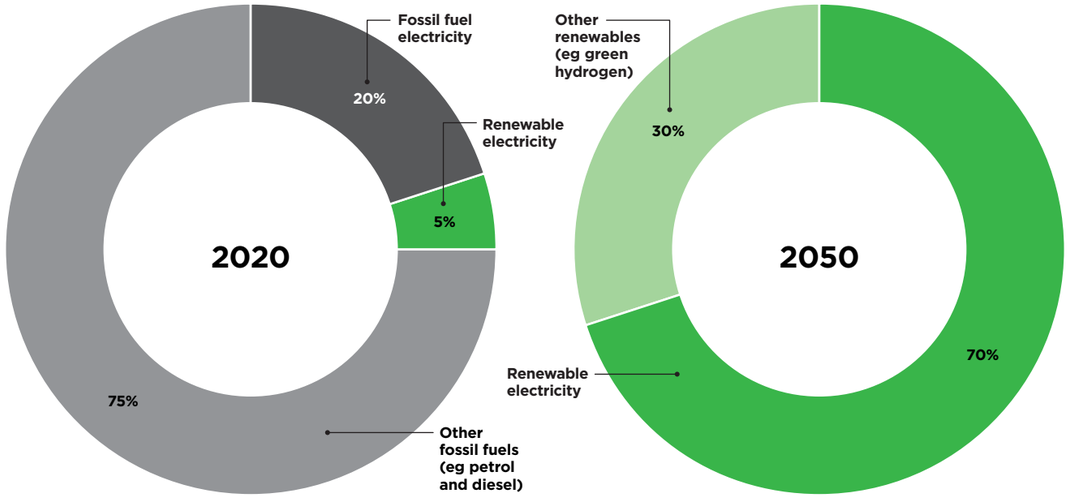
Net zero will be met by greatly expanding the use of renewable electricity, backstopped by green hydrogen.

Replacing CO_2 as the backbone of our energy system will require a massive allocation of capital to zero emission alternatives. This challenge will be met in large part by electrifying as many energy applications as possible—think electric vehicles. While this transition will happen over a few decades, the scale of the task is monumental.

Only a quarter of Queensland's current energy needs are met by electricity. And the bulk of that electricity is still generated with fossil fuels. By 2050, that proportion will need to rise to two-thirds and virtually all of it will need to be sourced from renewables. Note also that our total energy needs will increase materially over this period due to our growing population and our economy's ever-increasing appetite for energy.

Yet not everything can be fully electrified. High-energy applications such as steel production and other industrial processes will need to be decarbonised with clean fuels. The global community has nominated green hydrogen as the fuel of choice for hard-to-abate applications – more than 30 nations have released a hydrogen strategy in the last two years.

Final energy use by source, Qld, 2020 and 2050



Source: ABS (2020), CEC (2022); ETC (2021a); IEA (2021).
Note: 2050 is indicative and based on a net zero scenario using ETC (2021a; 2021b) and IEA (2021). 'Renewable electricity' of 70% and 'other renewables' of 30% based on ETC (2021a; 2021b) 2050 Indicative Scenario. 'Other renewables' in right chart could also include hydrogen based ammonia and synfuels, bioenergy and biomass.

"While this transition will happen over a few decades, the scale of the task is monumental."

Hydrogen is the hinge of the renewables transition

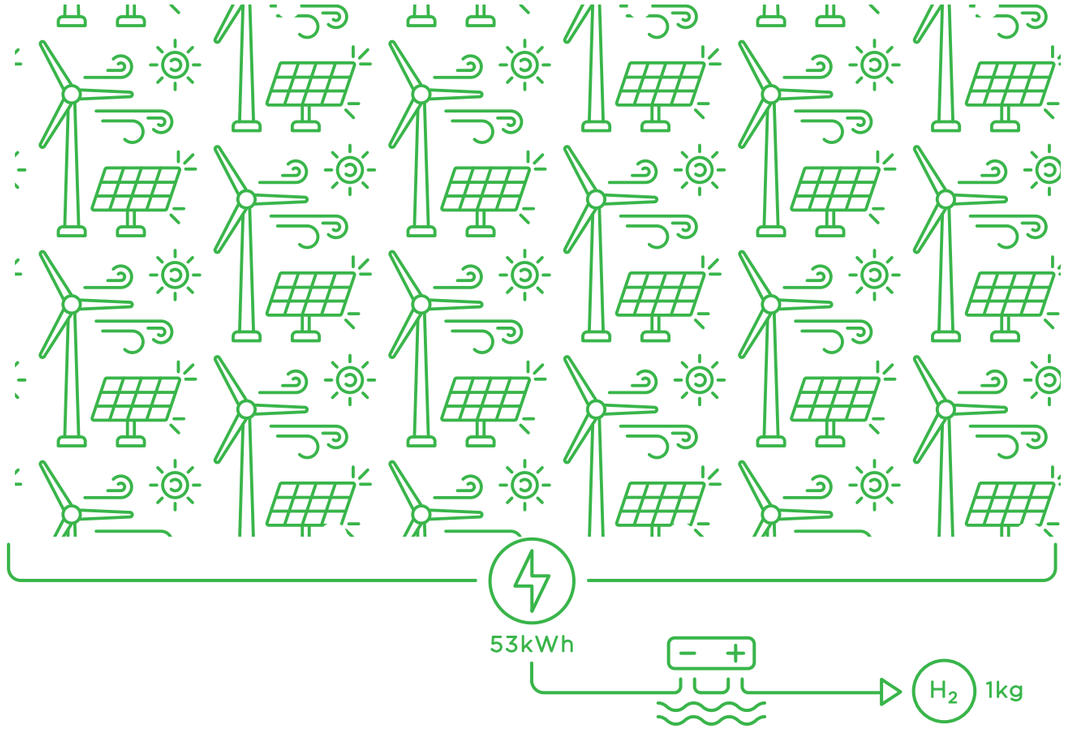
While electricity assets will attract most of Queensland's renewables investment, green hydrogen will be the key determinant of the scale of this investment.

The production of green hydrogen requires massive amounts of electricity. One kilogram of green hydrogen currently requires around 53kWh of electricity[ii]. As a result, most of the costs of a green hydrogen facility (~75%) are absorbed by the substantial renewable electricity assets that need to be installed to power the facility. Similarly, three-in-four construction workers required to build green hydrogen facilities will be employed on the renewable electricity projects needed to power those facilities.

This means that the scale of the overall renewables build-out will hinge on the role of green hydrogen in Queensland's future energy mix. A future with hydrogen will require as much as four times more renewable electricity investment than one focussed on simply replacing fossil-fuelled electricity with renewables-powered electricity.

Just how much green hydrogen Queensland produces will in turn be determined by Queensland's role as a hydrogen exporter. The demand for green hydrogen from Queensland's domestic economy is uncertain, but it will definitely be less than the demand from export markets. The overall renewables build-out will therefore be shaped in large part by how much green hydrogen the rest of the world is willing to buy from Queensland.

The production of green hydrogen requires massive amounts of renewable electricity



[ii] *IRENA (2020)*

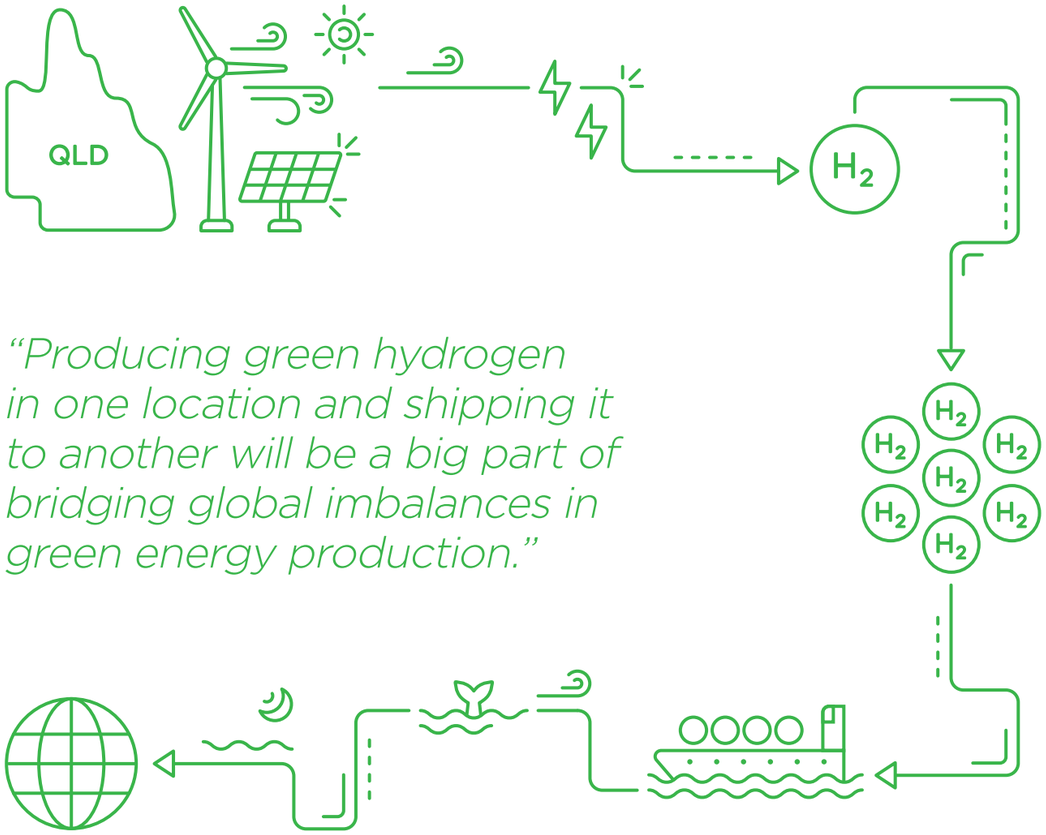
The hydrogen export opportunity

The challenge of decarbonising Queensland is substantial enough, but what if Queensland also helped to decarbonise the rest of the planet?

Many countries with ambitious net zero goals, such as Japan and South Korea, lack the natural assets to satisfy them. Other jurisdictions, like Queensland, enjoy a surplus of assets with relatively modest energy needs. Producing green hydrogen in one location and shipping it to another will be a big part of bridging these global imbalances.

Queensland is one of the world's best-endowed economies for large-scale renewable electricity production, boasting extraordinary natural assets of sunshine, wind, land and water. These comparative advantages put the state in a strong position to capture a large share of the green hydrogen export market. Northern Queensland, in particular, has been identified as one of the most cost-effective localities to produce green hydrogen.

The prospect of satisfying not only Queensland's domestic decarbonisation needs but also those of other countries dramatically increases the outlook for renewables investment in Queensland.



"Producing green hydrogen in one location and shipping it to another will be a big part of bridging global imbalances in green energy production."

How could the energy transition unfold?

We partnered with CSIRO to model three scenarios that correspond to different assumptions about Queensland's future hydrogen economy.

The scenarios used in this report are organised around the twin axes of export demand and domestic uptake of green hydrogen in Queensland. In all scenarios Queensland achieves domestic net zero by 2050.

Scenario 1 broadly corresponds to the policy ambition of the Queensland Government and many clean energy advocates. It is a future where green hydrogen is a major export commodity and an important part of the state's own energy mix.

Scenario 2 represents an outcome where Queensland captures a share of the global green hydrogen market but does not see considerable penetration of hydrogen into the domestic energy mix.

Scenario 3 is the opposite outcome – Queensland fails to capture a significant share of the export market but sees significant penetration of green hydrogen into the domestic sphere.

While hydrogen is the key differentiator between the scenarios, it is important to note the modelling captures the entirety of Queensland's renewable energy needs. The results under each scenario include as a constant the core level of renewables investment needed regardless of what happens with hydrogen.

The scenario where green hydrogen plays no role in Queensland's renewable transition was not explicitly modelled as it is considered unlikely. However, it is possible to 'back out' an approximation of this outcome by subtracting the hydrogen demand component from Scenario 2. This data is presented in the full report as the 'base component.'

"Each scenario models Queensland's total renewable energy needs, given different assumptions about the role of hydrogen."

Executive Summary | August 2022

Installed capacity to expand dramatically

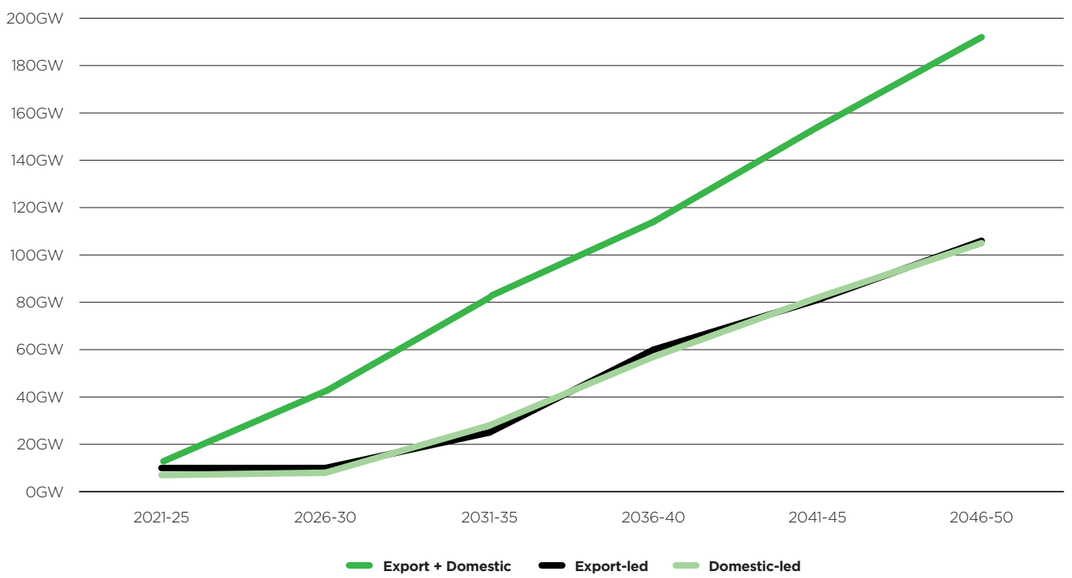
Queensland will need to install somewhere between 105GW and 192GW of renewables by 2050.

To put those figures into perspective, Queensland's current installed capacity of total energy generation is around 16.2GW. Less than a quarter of that capacity is renewable (3.8GW).

At a minimum, then, Queensland's total energy generation is expected to expand five-fold over the next few decades. Under the Export + Domestic scenario, the expansion could be more than 10-times current capacity.

The upshot of these numbers is that Queensland needs to expand its base of renewable power generating assets 27-fold by 2050. That's under the most conservative scenario. The more ambitious scenario where Queensland emerges as a hydrogen powerhouse would require a 50-fold expansion of renewable power generating assets. Even a future without any hydrogen at all would require a 14.5-fold increase in renewables.

Renewable power generation, cumulative installed capacity, all renewables-related activity, Qld



Source: CSIRO (2022) for CSQ.
Note: GW is Gigawatts

"Queensland will need to expand its base of renewable power generating assets by as much as 50-fold by 2050."

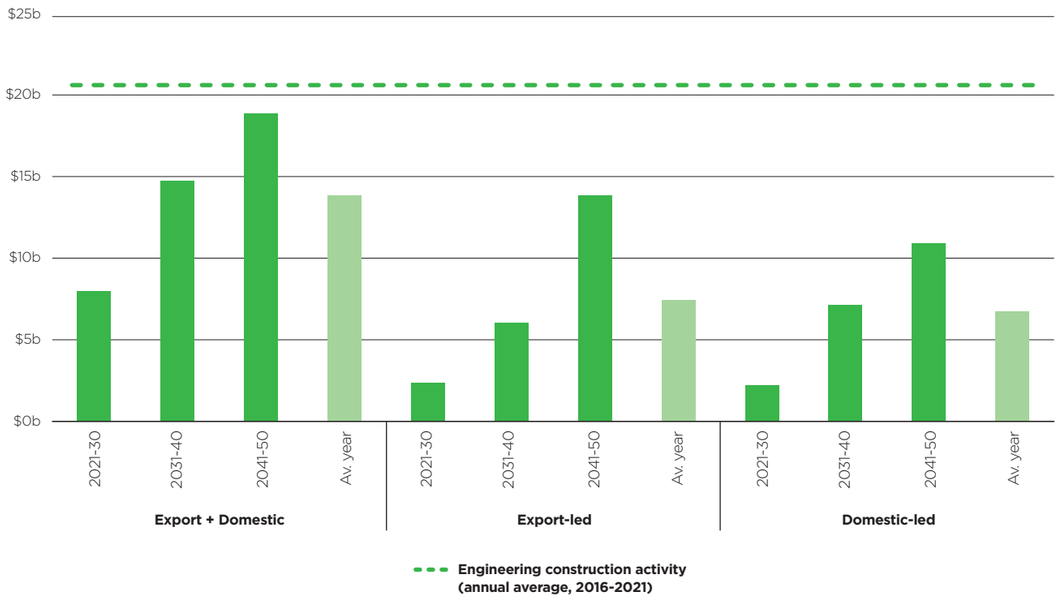
The investment response

Queensland's renewable energy requirements will drive a step-change in construction demand in Queensland.

A substantial amount of capital will be allocated to the construction of renewable energy assets over the coming decades in Queensland. We estimate that capital expenditure on renewables could range from $6.7 billion to $13.9 billion per annum out to 2050.

This constitutes a significant addition to the demand for construction services in Queensland. Renewables projects are classified as 'engineering' construction activity, a category that also includes infrastructure, heavy industry and recreational projects. Engineering construction activity has been running at around $20 billion per annum over recent years in Queensland. The renewables transition is therefore expected to add 34%-70% to Queensland's baseline level of engineering construction.

Renewable-related annual CAPEX, Qld, 10 year intervals



Source: ABS (2021); CSIRO (2022) for CSQ.

"A substantial amount of capital will be allocated to the construction of renewable energy assets over the coming decades in Queensland."

The build-out is well underway

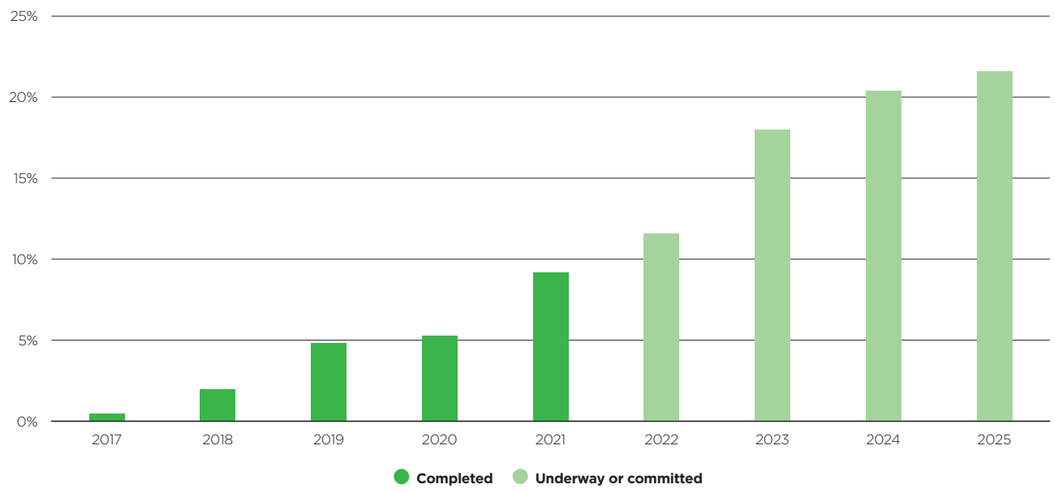
The renewables construction boom is no longer a 'what if' – it is well established across many parts of Queensland.

CSQ maintains the most comprehensive database of renewables projects in Queensland—the Queensland Renewable Energy Projects (QREP) database. QREP data can be explored at a state-wide, regional and project level at csq.org.au/renewables.

Our analysis of QREP data suggests that around $21 billion of renewable projects are already underway or committed to be delivered by 2025. This figure excludes $56.6 billion worth of planned or possible projects in the database that are in much earlier stages of consideration. Some of these may go ahead, others may not.

The renewables pipeline corresponds to around 20% of Queensland's total major project pipeline. This represents a significant increase over recent years – in 2019, the renewables share of major projects was closer to 5%. This suggests the renewables pipeline is growing faster than many realise.

Renewables share of major construction projects, Qld



Source: CSQ QREP databse (2022), CSQ MP database (2022)
Note: Five year rolling average by project end date

The labour response

The level of construction activity required to deliver Queensland's renewable transition will drive a step-change in the construction workforce.

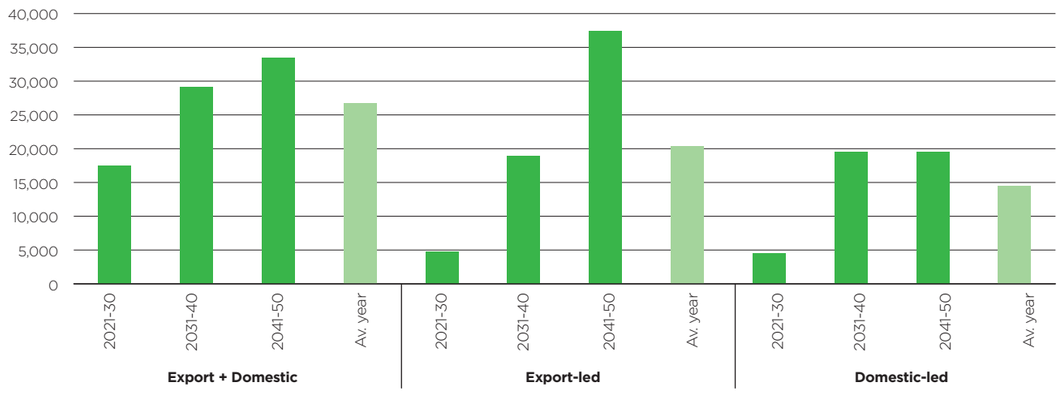
The immediate labour requirement for renewables construction is not trivial. We estimate that delivering the renewable projects already underway or committed to 2025 will absorb around 4,600 construction workers in Queensland. That is against the backdrop of a pool of approximately 80,000 deployable workers.

Over the longer term, labour pressures grow considerably. The estimated number of construction jobs that will be directly created by Queensland's renewables build-out will range from 14,500 to 26,700.

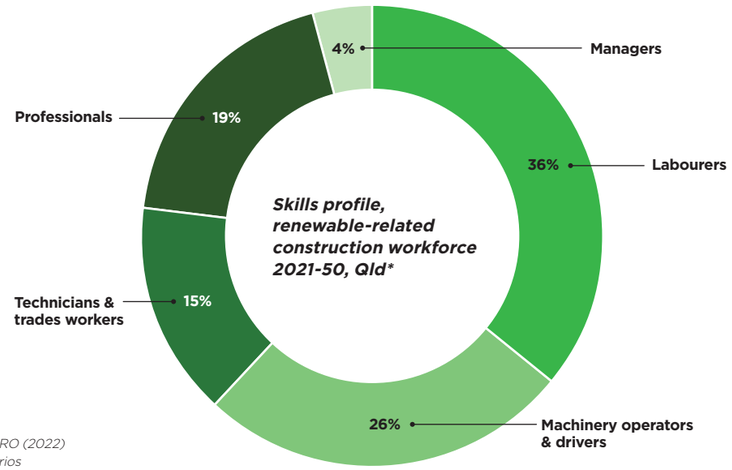
Around half of this labour demand will be absorbed by the hydrogen economy. A future without any hydrogen would require only 8,200 construction workers for the renewables build-out.

Our modelling suggests that middle- and low-skilled jobs will dominate the labour profile of the renewables construction workforce. Middle-skilled tradespeople and machine operators, along with low-skilled labour, will absorb most of the jobs created by the renewables transition.

Renewable-related construction workforce, Qld, 10 year intervals



Source: CSIRO (2022) for CSQ.



Source: CSQ modelling of CSIRO (2022)
** average profile across scenarios*

Executive Summary | August 2022

A comparison to the mining boom

The impact of the renewables transition on the construction workforce will be roughly equivalent to the mining boom – but permanent.

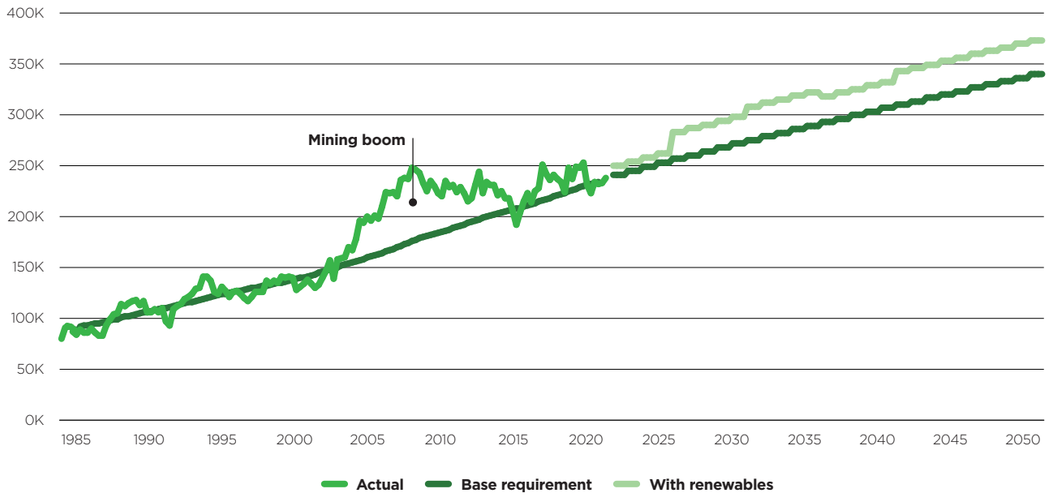
The mining boom provides an interesting point of comparison to put the renewables build-out into perspective. Queensland's construction workforce reached 250,000 at the peak of the mining boom. We estimate this represented a 13% increase on the labour required to service the baseline construction needs of Queensland's population.

Looking forward, the renewables build-out will require a similar addition to the workforce – around 10% per annum under the Export + Domestic scenario. However, there are two key points of difference with the mining boom. The first is that the mining boom was a short and sharp demand-side shock. The renewables transition will be a long-term, probably permanent change in the level of construction demand in Queensland.

The second important difference is that the increase in construction employment during the mining boom included the indirect or 'spillover' effects of the boom. For example, the mining boom created a housing boom in certain parts of Queensland. A significant amount of infrastructure was also built to support the new assets. The 13% increase in construction employment includes all those activities, not just direct mining investment.

By contrast, our estimates of the renewables labour requirement only include labour that would be directly employed on renewable projects. They do not include any spillovers to housing, infrastructure or renewables-adjacent assets, such as water desalination plants which may need to be co-located with green hydrogen facilities. It is therefore likely that the overall impact of the renewable transition on the construction workforce will be materially higher than the estimates provided here.

Additional construction employment from renewables transition, Qld, Export + Domestic scenario



Source: ABS (2022); CSQ modelling of CSIRO (2022)

"The renewables transition will be a long-term, probably permanent change in the level of construction demand in Queensland."

A regional boom

Almost all of Queensland's renewable investment will land in the regions.

Our modelling suggests that regional Queensland is the most cost-effective location for most types of renewables investment.

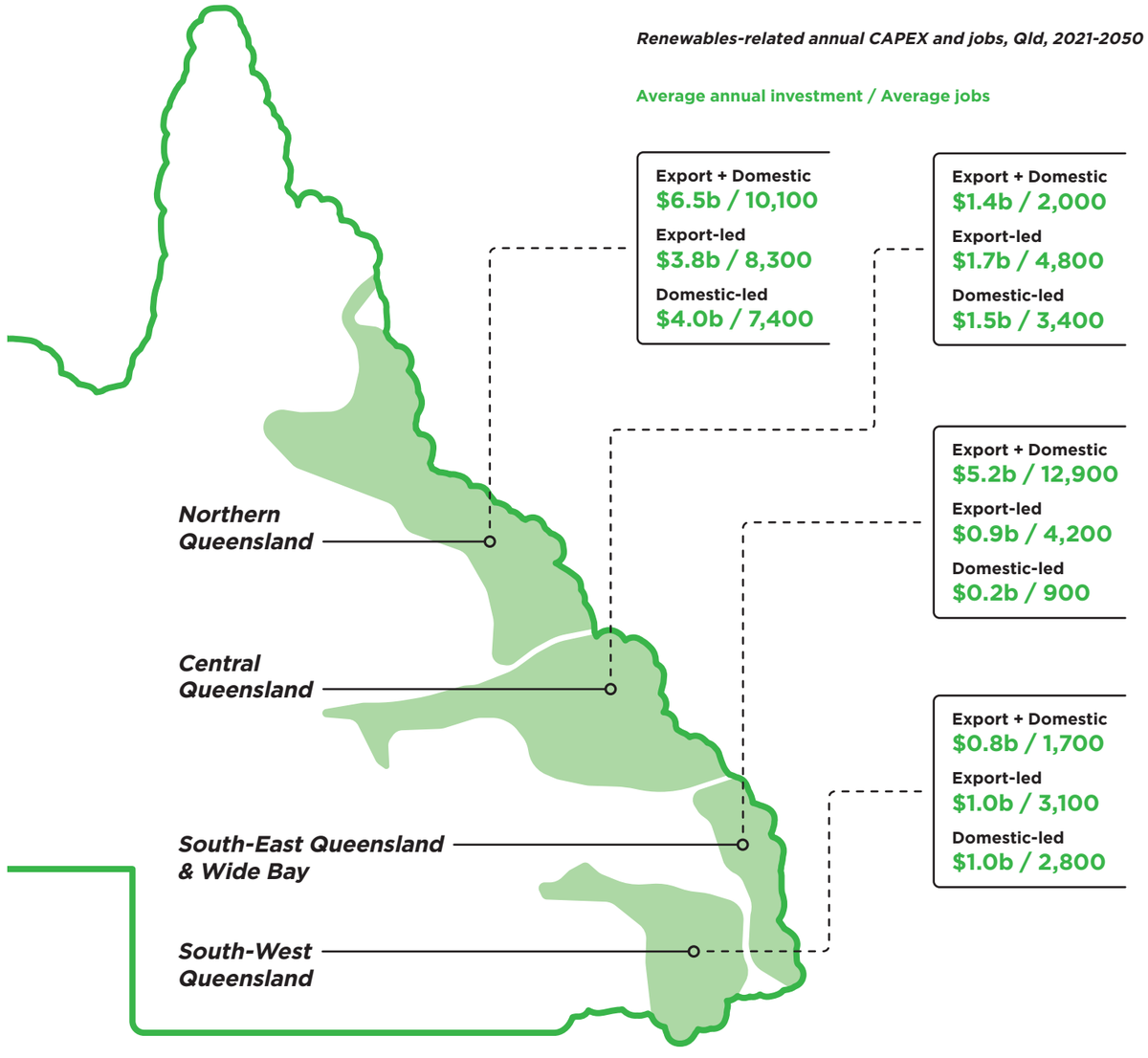
Between 62% and 96% of investment will be spread across three areas of regional Queensland. Northern Queensland is the standout performer, capturing between $3.8 billion and $6.5 billion of renewables investment per year up to 2050.

The labour picture broadly mirrors the pattern of investment – between 52% and 94% of the construction jobs created by renewables projects will be located in regional Queensland.

That said, there is a clear role for South-East Queensland and Wide Bay, particularly in the Export + Domestic scenario which sees these regions capturing a larger share of construction labour.

Renewables-related annual CAPEX and jobs, Qld, 2021-2050

Average annual investment / Average jobs



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Visit **csq.org.au/renewables** to download the full report and access further data and insights

For further information, please contact the team at research@csq.org.au