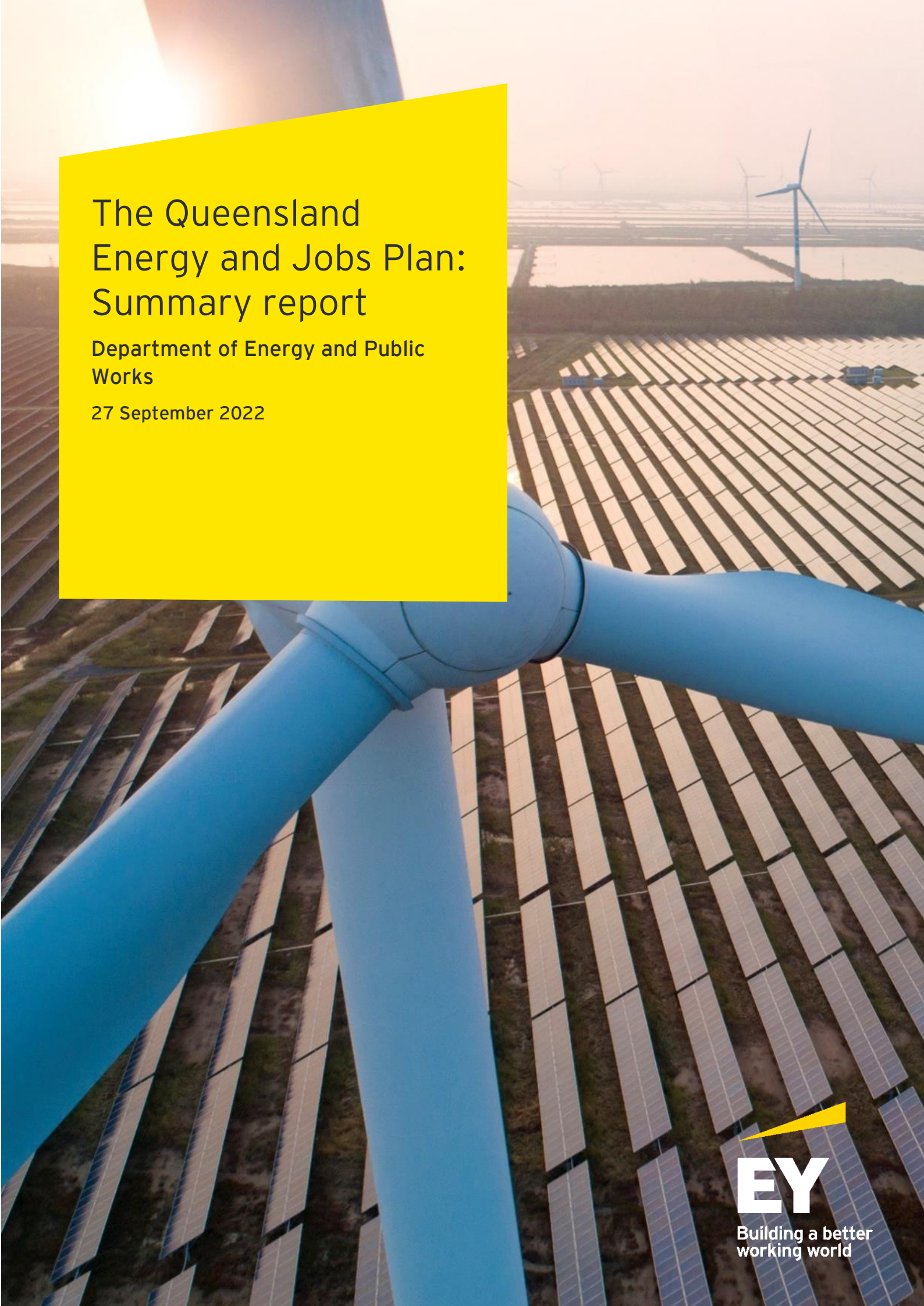

The Queensland Energy and Jobs Plan: Summary report

Department of Energy and Public Works

27 September 2022

Building a better working world

Building a better working world

RELEASE NOTICE

Ernst & Young was engaged on the instructions of Department of Energy and Public Works ("the Department") to deliver a report describing modelling outcomes of the Queensland Government's Queensland Energy Plan on electricity market outcomes, job and industry development outcomes, and its effect on the broader Queensland economy.

This report (the "Summary Report") has been prepared on the specific instructions of the Department and is based on detailed EY's reports, the *Queensland Energy and Jobs Plan: electricity market and economic modelling outcomes* dated 23 September 2022 and *The Queensland Energy and Jobs Plan: A Plan for Greener Growth* dated 27 September 2022[1] (the "Reports") and summarises the key outputs only. Given the Summary Report only contains selected sections of the Reports and does not contain detailed assumptions, methodology, scenarios and qualifications, it may not give complete understanding of the background, context, findings and the analysis. A reference to the Summary Report or the Reports includes any part of the Summary Report and the Reports. No further work has been undertaken by EY since the dates of the Reports to update them.

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Readers are advised that the information provided is based on detailed assumptions. These assumptions were selected by the Department after consultation with other stakeholders. The modelled scenarios represent several possible future options for the development and operation of select industries Alternative futures beyond those presented have not been evaluated as part of this Summary Report.

[1] These two reports are two distinct reports but we have, at the Department's request, merged the important aspects of the two reports into this Summary Report

Environmental sustainability is becoming an increasing priority for consumers, businesses, and governments worldwide. As countries and industries move towards low-carbon practices, renewable energy commitments are being set to provide clarity and confidence to business and consumers. The Queensland Government has a 50% Renewable Energy Target by 2030 and has developed an Energy Plan as a roadmap to reach this Target and decarbonise the electricity grid.

Global technology, markets, and policies directed towards developing and implementing emissions reductions targets are impacting Queensland's industrial base. These are major structural drivers which present opportunities and challenges for the state's economy. To address challenges and capture green growth, the Queensland Government has developed an Energy and Jobs Plan (the Energy Plan) to provide market confidence and investment into the state's electricity grid. The Energy Plan details a pipeline of investment into renewable energy generation, storage and transmission that will reduce the emissions intensity of Queensland's electricity supply.

The Department of Energy and Public Works engaged EY to conduct modelling and analysis to quantify the outcomes of the Energy Plan for the electricity sector and the Queensland economy. This report summarises EY's assessment of the impact of implementing Queensland's Energy Plan. The economic assessment compares the market and investment opportunities under the Energy Plan against an Uncoordinated Outlook in which no plan was implemented. Three key dimensions are examined:

- The electricity market, including electricity prices and the emissions intensity of electricity, which was modelled using EY's 2-4-C electricity market model.
- The broader economic impacts of the Energy Plan on output, investment, and household incomes which was modelled using EY's GEM computable general equilibrium model.
- Key potential industry impacts under the Energy Plan which were examined using industry-specific analysis, including potential economic output and employment across:
  - Metal refining
  - Resource mining
  - Green hydrogen
  - Battery manufacturing.

This report summarises outcomes from EY's reports the *Queensland Energy and Jobs Plan: electricity market and economic modelling outcomes* and *The Queensland Energy and Jobs Plan: A Plan for Greener Growth*. These two reports contain additional detail on the scenario input assumptions, methodology and qualification of outcomes referenced in this summary report.

Two scenarios selected by the Department have been modelled over a 17-year horizon from 2023-24 to 2039-40:

- Uncoordinated Outlook: Assumes that the Queensland Government does not make early investments in the electricity sector and there is no clear plan for the energy transformation available in the public domain. Investment in generation and storage occurs in response to electricity market signals only and policies already in place to promote renewables in other states.
- Energy Plan: Represents an outlook where there is an infrastructure blueprint for the transformation of the Queensland energy sector including key decisions relating to publicly-owned assets as well as proactive investment in wind and solar generation, pumped hydro storage and the transmission network.

The industry-specific analysis extends the differences between scenarios based on potential industry-specific impacts.

Table 1 summarises the differences in assumptions between the scenarios in the electricity market modelling and whole of economy (computable general equilibrium) modelling. The industry-specific analysis extends the differences between scenarios based on potential industry-specific impacts.

Table 1: The differences in assumptions between the scenarios selected by the Department

Assumption	Uncoordinated Outlook	Energy Plan
QRET	No explicit targeting of the QRET	QRET to be met – 50% renewable generation as a percentage of consumption by 2030
Coal-fired generation retirement schedule	Announced retirement dates	Queensland coal-fired generation withdrawals across units from 2026-27 as advised by the Department based on the Infrastructure Blueprint[2]
Transmission network augmentations	As per the 2022 ISP optimal development path	Additional augmentations in Queensland to support new capacity. This does not include CopperString[3] due the complexity of adding another region to the model.
Pumped hydro	Committed projects only	Borumba (2 gigawatt (GW), 24 hour) in 2029-30 Proxy 5 GW North Queensland Pumped Hydro[4] made up of: ▶ North Queensland (3 GW, 24 hour) in 2032-33 ▶ Additional pumped hydro storage (2 GW) (modelled as 8-hour batteries[5], 1 GW in 2031 and 1 GW in 2033)
Renewable and firming capacity	Market-driven capacity only	Early investment in renewable and storage capacity backed by the Queensland Government or private industry
Weighted-average cost of capital (WACC) for new generation and storage in Queensland (pre tax, real)	5.5%[6]	4.8% A lower WACC was selected by the Department informed by independent analysis. It is based on anticipated lower risk due to increased policy certainty and reflects broad benefits to the market anticipated as a result of publishing the Queensland Energy Plan and Infrastructure Blueprint and the actions contained within

In the Energy Plan scenario, large-scale capacity mix is forecast to change significantly from a predominately coal-fired capacity mix in 2023-24, to a largely renewable capacity mix in 2039-40 (Figure 1). The withdrawal of coal-fired generation and investment into renewable assets results in a capacity mix which is greener and more than double the current large-scale capacity. Investment in energy assets including generation, storage and transmission is forecast to reach $76 billion in real terms by 2040.

[2] The Infrastructure Blueprint is a technical document prepared by the Queensland Government outlining the investment pathway for major infrastructure in Queensland's electricity system under the Energy Plan.

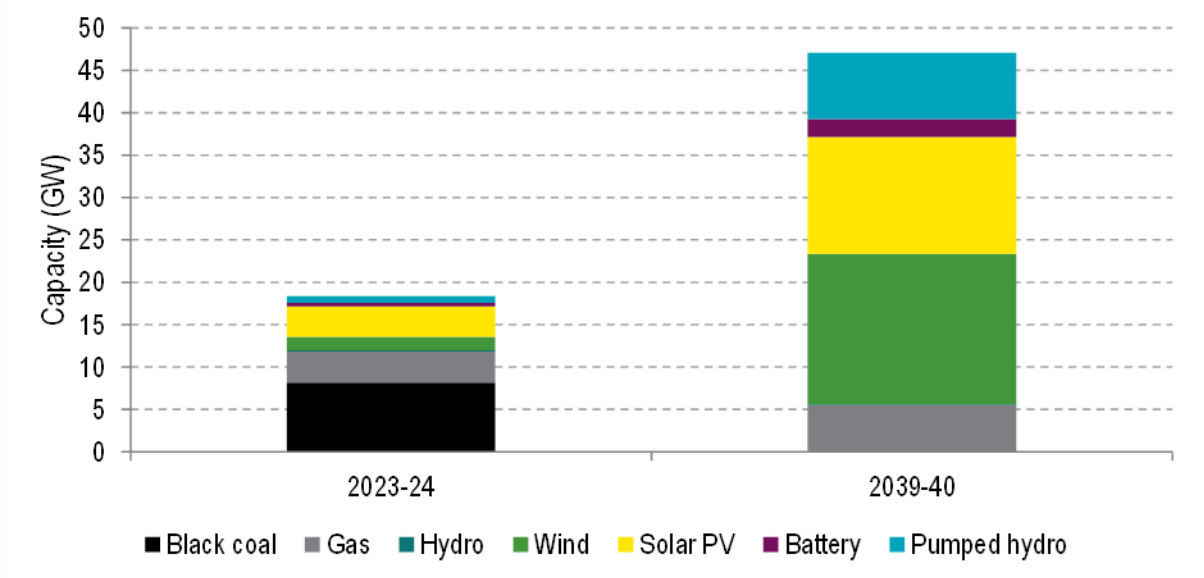
[3] Queensland Government State Development, Infrastructure, Local Government and Planning, 2 March 2022, *CopperString Project overview*. Available at: https://www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/current-projects/copperstring-project

[4] At the time of modelling, the North Queensland Pumped Hydro project was not in the public domain.

[5] Assuming 8-hour batteries is a modelling simplification agreed with the Department and this is intended to represent pumped hydro with 24 hours of storage.

[6] AEMO, 30 June 2022, *2022 Inputs, assumptions and scenarios workbook.* Available at: https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/inputs-assumptions-and-scenarios-workbook.xlsx

Figure 1: Forecast large-scale capacity mix under the Energy Plan (excluding distributed energy resources such as rooftop solar)

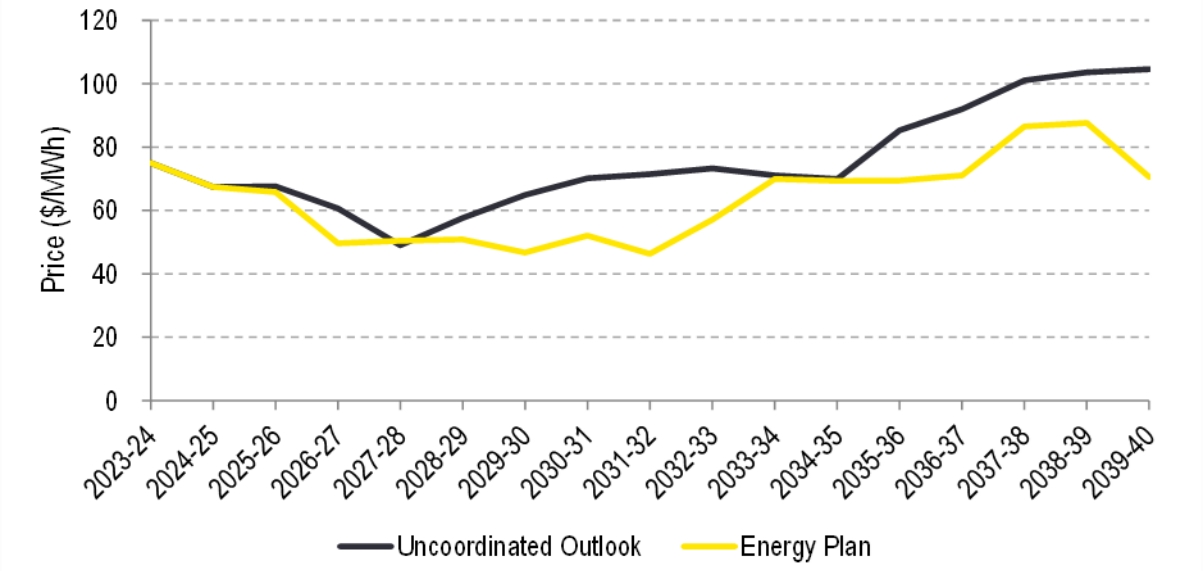


Source: EY analysis

The Energy Plan lowers electricity prices across Queensland

This capital installation is forecast to replace the state's predominately coal-fired electricity supply, while keeping wholesale electricity prices at an average of 15% lower until 2040, compared to the Uncoordinated Outlook (Figure 2). The lower average wholesale electricity price outcomes in the Energy Plan Scenario are forecast due to investments in electricity infrastructure in the Energy Plan Scenario, namely large pumped hydro projects, transmission network projects and more wind and solar capacity commissioned proactively. Lower forecast electricity prices will benefit households and established industry.

Figure 2: Forecast wholesale electricity prices compared across both scenarios



Source: EY analysis

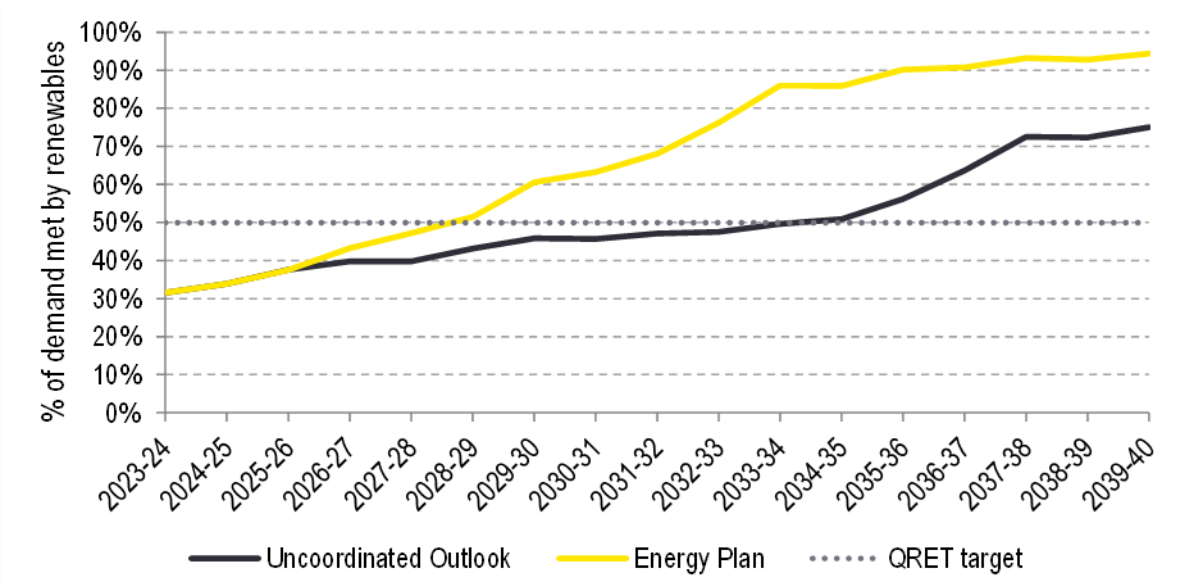
By 2040, the Queensland network and capacity mix are forecast to be very different in the two scenarios. In the Energy Plan Scenario there is no Queensland coal-fired capacity remaining online and there are further opportunities for wind and solar investment. For these reasons, it is expected

that wholesale market prices would continue to be steady in the Energy Plan Scenario beyond 2040.

Under the Energy Plan Scenario Queensland's electricity market prices are less dependent on fuel prices, particularly coal prices, due to there being less coal fired generation in operation. The market is therefore more resilient to future price shocks resulting from global instability, such as the most recent outcomes in the energy sector during winter 2022, which were driven in part by global factors like overseas conflict.

Under the Energy Plan, Queensland is forecast to meet its 2030 Renewable Energy Target of 50% earlier than planned, creating economic and employment benefits for established and emerging industries. In the Uncoordinated Outlook scenario, the renewable energy target is not expected to be met (Figure 3).

Figure 3: Forecast Queensland electricity demand met by renewables under both scenarios



Source: EY analysis

The Energy Plan creates benefits throughout the modelling period across electricity prices, emissions reduction, and renewable energy generation as summarised in Table 2

Table 2: The Energy Plan's impact on electricity market outcomes compared to the Uncoordinated Outlook

Policy objective	2029-30	2031-32	2039-40
Reduced electricity bills for households	-$112	-$150	-$190
Reduced electricity bills for small business	-$1,115	-$1,495	-$1,904
Reduced electricity emissions for Queensland generators compared to 2005 levels (Uncoordinated Outlook Scenario in brackets)	-50% (-34%)	-60% (-33%)	-96% (-71%)
Renewable energy generation as percentage of Queensland electricity demand (Uncoordinated Outlook Scenario in brackets)	61% (46%)	68% (47%)	94% (75%)

Source: EY analysis

Helping Queensland's metal refining industries decarbonise

Queensland's metal refining industry contributes significantly to economic activity, employment, and exports. The industry is dominated by non-ferrous metal refineries including aluminium, copper, and zinc. As one of the most electricity intensive industries in the state, the Energy Plan is

expected to deliver low-cost renewable electricity to these refineries and reduce input costs while improving the environmental credentials of the industry.

The aluminium and alumina refining industries are expected to benefit under the Energy Plan due to their high Scope 2 greenhouse gas emissions, while zinc and copper refining are likely to see moderate additional growth. Overall, the Energy Plan is forecast to support a further $3 billion in metal refining output in 2040, supporting 2,500 direct additional jobs in the industry.

New resource extraction to underpin a low carbon future

A decarbonised electricity grid is expected to drive limited or moderate additional growth in Queensland's resource mining industry under the Energy Plan. Strong global demand for aluminium (produced from bauxite), zinc, and copper is expected to lift the industry in both scenarios.

Most mining operations are located outside of the state's electricity grid and therefore are unlikely to benefit directly from lower electricity prices and emissions under the Energy Plan. However, critical minerals such as vanadium are emerging as crucial to the transition towards a low-carbon future, presenting Queensland with a significant growth opportunity. Overall, production in the resource mining industry, excluding coal, could increase by $5 billion under the Energy Plan in 2040, supporting 5,200 direct additional jobs.

Green hydrogen gathering momentum as a global energy solution

Green hydrogen involves the use of renewable and zero emissions energy to produce hydrogen Queensland is emerging as one of the lowest cost locations for producing green hydrogen in the world due to its abundance of solar and wind resources There is already a strong pipeline of green hydrogen production such as the Fortescue Future Industries hydrogen hub in Gladstone Further investment in renewable energy under the Energy Plan could continue to support this growth By implementing the Energy Plan, the state's hydrogen industry could be $19 billion larger in 2040, creating 4,350 direct additional jobs

Battery manufacturing and related services have growth potential

The battery manufacturing supply chain is complex, ranging from resource mining to the integration and development of innovative technologies. Queensland already has a strong position in the upstream mining and refining of resources such as alumina, aluminium and copper. There is potential for the state to mine and process critical minerals such as vanadium. Further, the state's demand for small and big battery storage is expected to grow significantly. It is expected households will continue to install residential scale batteries to complement their solar generation, utility-scale batteries are expected to be deployed to service the grid, and large off-grid industries are expected to install industrial batteries to secure reliable, renewable energy supply.

Queensland's ability to capture all parts of the battery supply chain faces some uncertainty, including developments in global manufacturing supply chains. However, under the Energy Plan alongside targeted policies and investments to grow the battery manufacturing industry in Queensland, expanded growth opportunities could total $2 billion in 2040, supporting 9,800 direct additional jobs.

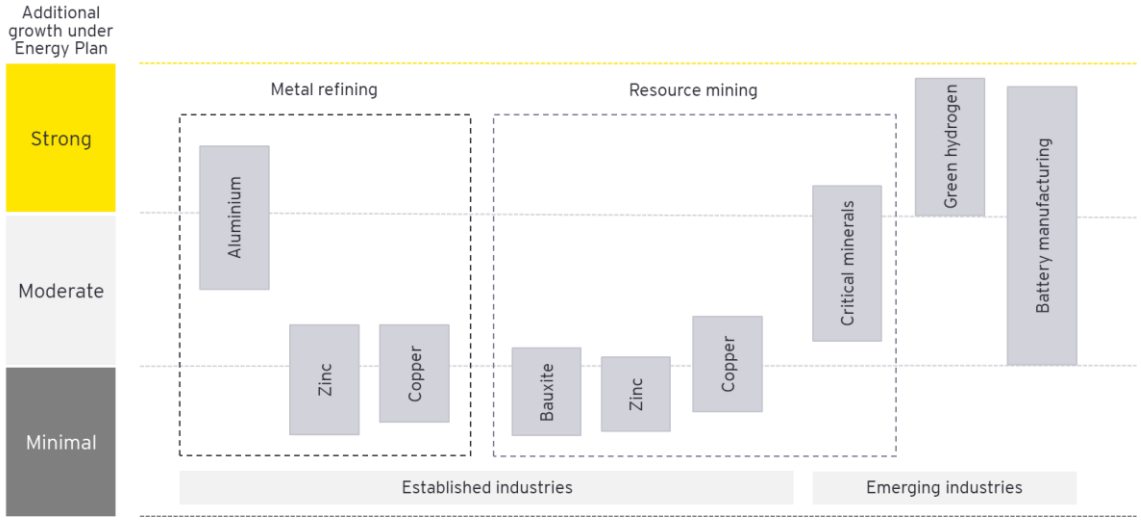
Broad-based industry gains could be significant

By decarbonising the electricity grid and providing long term policy certainty for industry, the Energy Plan has the potential to unlock opportunities in Queensland's established and emerging industries. The economic payoff from this growth is forecast to be significant.

Figure 4 shows the potential impact of the Energy Plan across key established and emerging industries. The figure highlights the Energy Plan's additional growth impact which would be over

and above a baseline growth trajectory, which for many of Queensland's industries is already buoyant.

Figure 4: Additional industry output under the Energy Plan compared to the Uncoordinated Outlook



Source: EY analysis
Note: The length of the bar reflects the scale of potential uncertainties in each industry outlook.

The Energy Plan could generate an additional $21 billion in output in emerging industries (green hydrogen and battery manufacturing) and almost $8 billion additional output for established industries (metal refining and resource mining) by 2040. The Energy Plan could create 22,000 direct jobs, most of which are likely to be in regional Queensland , and a further 14,200 indirect jobs by 2040, resulting in more than 36,000 additional direct and indirect jobs.

Broader economic impacts of the Energy Plan

Queensland's Energy Plan is a policy to drive significant public and private investment into the state's electricity infrastructure. This investment involves increasing Queensland's renewable energy generation by five times over the next two decades. Significant benefits are expected to emerge in regional areas as 95% of the Energy Plan's investment is expected to be directed into regional Queensland.

Macroeconomic analysis of the Energy Plan suggests it could contribute up to $25.7 billion to the Queensland economy by 2040 compared to the Uncoordinated Outlook scenario. The economic benefits are derived through three key channels:

- Investment and economic activity flow into Queensland as capital investments by government and the private sector into renewable generation and transmission stimulates growth
- Lower electricity prices provide cost and cash flow benefits to households and industry
- A green grid facilitates new investment in clean energy industries.

Economic modelling, using EY's in house CGE model, was undertaken to assess the economic outcomes of the Energy Plan Scenario compared to the Uncoordinated Outlook Scenario over the modelled horizon to 2039-40. Outcomes are summarised in Table 3. Under the Energy Plan Scenario, economic output in Queensland is projected to be up to $25.7 billion higher than the Uncoordinated Outlook Scenario in Net Present Values (NPV) terms. Reflecting the size of the capital installation, there is a significant boost in the first decade of the Energy Plan, coinciding with the peak of construction activity. Over the longer term, the major economic outcomes are expected to accrue through higher levels of induced investment, which could increase by over $25 billion in aggregate terms, and gains via improving Queensland's attractiveness as a green producer.

Table 3: The forecast economic impact of the Energy Plan over the modelling period, relative to the Uncoordinated Outlook Scenario

Economic variable	Value
Gross State Product	$25.7 billion
Gross State Income	$25.1 billion
Total investment	$23.2 billion
Household income	$10,380 per household

Source: EY analysis
Note: All values are presented as NPVs which use a 7% discount rate

Reflecting the scale of investment and capital modernisation within the Energy Plan, it has the potential to generate significant employment benefits for Queensland, especially in regional areas where much of the new infrastructure will be installed.

The development of energy infrastructure outlined in the Energy Plan could support 28,500 direct jobs on average each year through construction, manufacturing, and operation of renewable energy assets. 70% of these jobs could be in regional Queensland as investment flows to the regions. This capital investment is expected to support a further 35,000 indirect jobs in services, hospitality, and other industries across Queensland, resulting in a total of 64,000 average jobs each year. Importantly, these jobs are over and above the boost to employment that is possible as new sunrise sectors, like green hydrogen, take hold and accelerate.

The economic impact of

Queensland's Energy and Jobs Plan

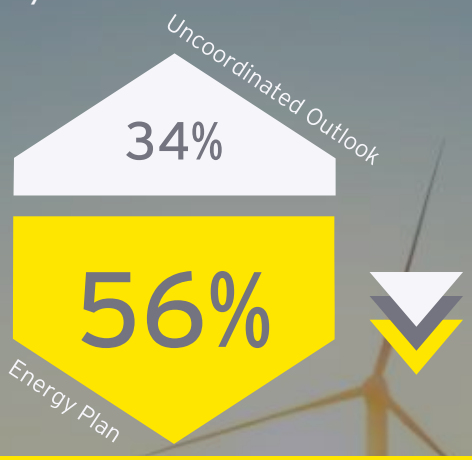
To capture the opportunities of a low carbon future Queensland has developed the Energy and Jobs Plan. This plan will seek to decarbonise the electricity grid and meet the State's renewable energy target of 50% by 2030 and beyond.

About the Energy Plan

The Queensland Government has put forward an Energy and Jobs Plan to guide the market and drive investment into the State's electricity grid. The Plan will drive significant investments, including by Queensland government-owned corporations, into wind and solar generation, pumped hydro storage and expanding the transmission network.

These new investments are expected to reduce the emissions intensity of electricity generated in the State and deliver lower electricity prices for customers

By 2030 the Energy Plan is forecast to reduce emissions by 56% relative to 2005 levels



Two scenarios were modelled from 2023 to 2040

An outlook where there is a robust vision and infrastructure blueprint for the transformation of Queensland's energy sector resulting in:

Energy Plan

$76 billion invested by 2040

Uncoordinated Outlook

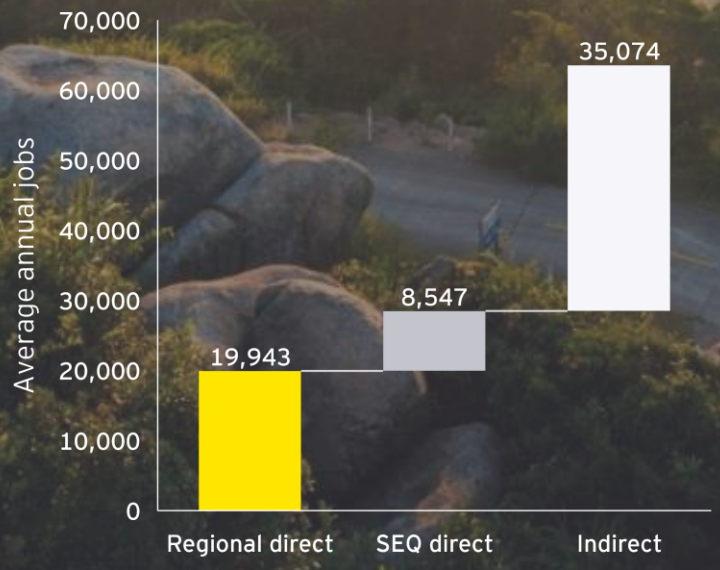
No early investments in the electricity sector and no clear plan for the energy transformation available in the public domain

The Energy Plan investment could boost economic activity by

$26 billion

supporting 64,000 jobs

The Energy Plan could create 28,500 direct jobs across construction, manufacturing, and operations, with almost 20,000 of these jobs located in regional Queensland. This significant investment is also expected to support more than 35,000 indirect jobs.

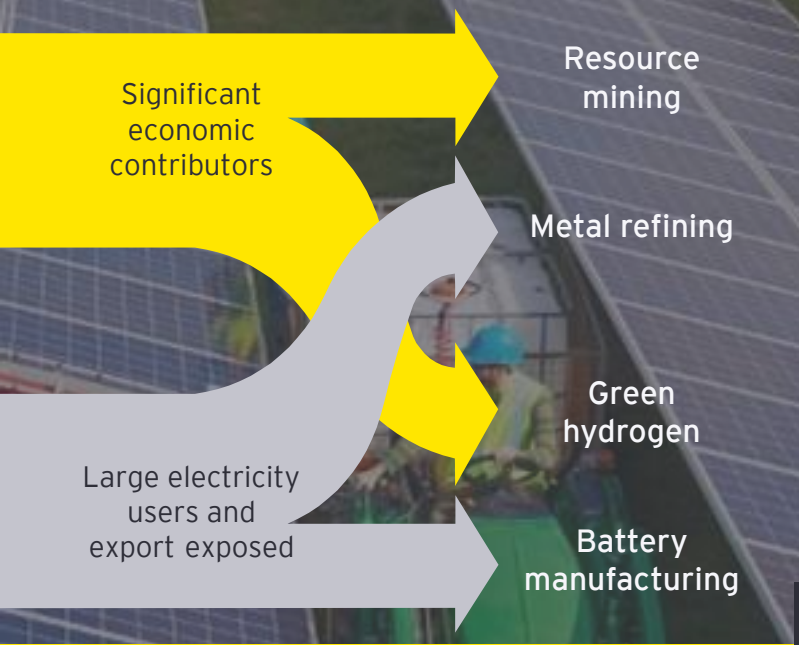


EY

The economic impact of Queensland's Energy and Jobs Plan

The Energy Plan could unlock opportunities for established and emerging industries

By delivering low emissions and low-cost electricity to Queensland, the Energy Plan is likely to impact on industries that are economically significant, large electricity consumers, and have export-exposed supply chains.



Additional economic activity in 2040 could support 36,000 direct and indirect jobs

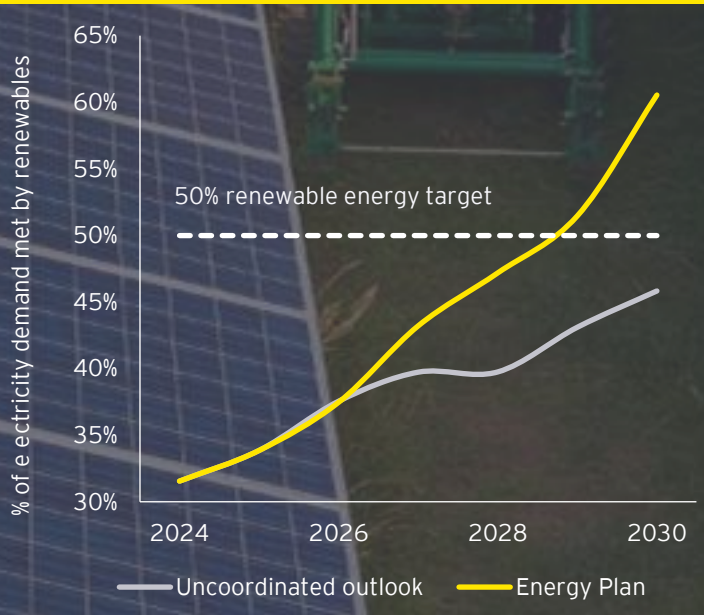
$5 billion
8,600 jobs

$3 billion
5,500 jobs

$19 billion
10,000 jobs

$2 billion
12,000 jobs

The Energy Plan supports the state in attracting green investments by reaching its renewable energy target of 50% by 2030



Without the Energy Plan, the state is not expected to reach its target by 2030

These outcomes reflect the benefits of

Lower electricity prices improving profitability

Cleaner energy unlocking green premiums

Earlier access to renewable energy

Growth in clean energy industries

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Enabled by data and technology, diverse EY teams in over 150 countries provide trust through assurance and help clients grow, transform and operate.

Working across assurance, consulting, law, strategy, tax and transactions, EY teams ask better questions to find new answers for the complex issues facing our world today.

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