# Enabling Queensland's hydrogen production and export opportunities

October 2022

Queensland Government

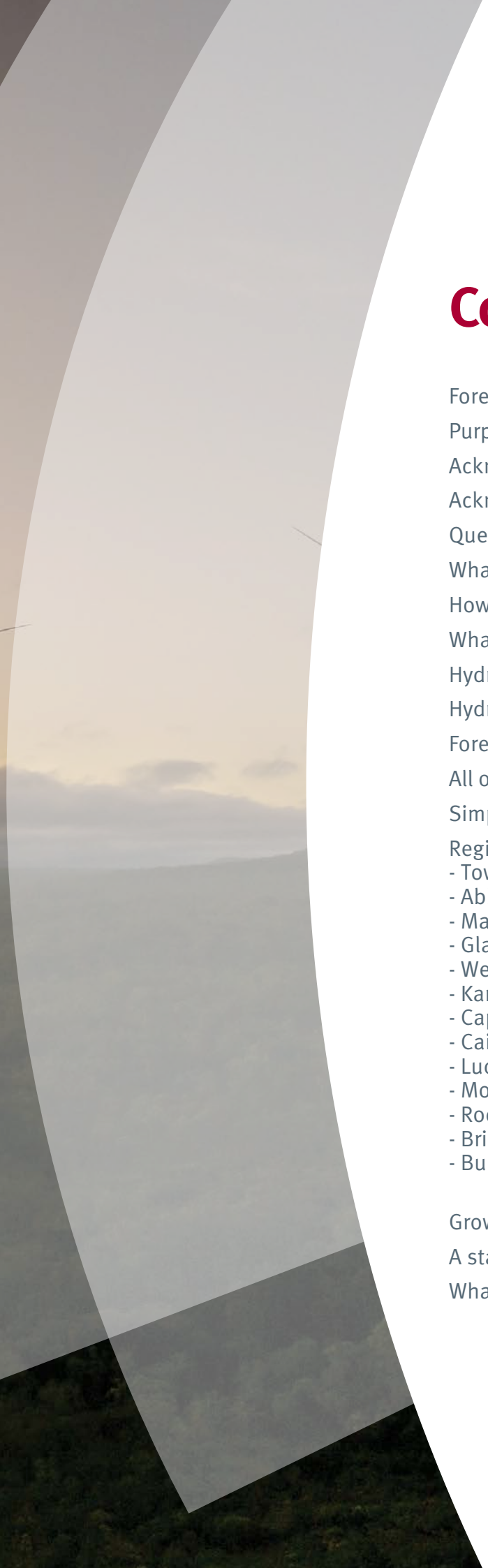
This publication has been compiled by the Department of Energy and Public Works.



**Interpreter statement:**

The Queensland Government is committed to providing accessible services to Queenslanders from all culturally and linguistically diverse backgrounds. If you have difficulty in understanding this document, you can contact us within Australia on 13QGOV (13 74 68) and we will arrange an interpreter to effectively communicate the report to you.

Front cover (L to R): Kidston solar project. Photo courtesy of Genex Power. Port of Townsville.
Inside cover: Kaban wind farm.



# Contents

# Minister's foreword

Since Queensland, Australia and most other nations committed to net zero emissions by 2050, global interest for Queensland's green hydrogen has grown rapidly, with demand forecast to increase in both domestic use and international export to around 280 megatonnes per year by 2050*.

The Palaszczuk Government has long supported the industry, promoting our publicly-owned port, land, renewable energy, and water infrastructure, as well as the unique levers our government has to progress and coordinate major project delivery.

We commissioned this comprehensive report to ensure investors and our trading partners can properly quantify the value of these natural and publicly-owned assets. It is a key deliverable on our journey to establishing Queensland as the world's renewable energy and green hydrogen superpower.

We have sought to provide strategic insight for Queensland hydrogen production and export facilities with in-depth assessments for both local and international proponents. It will support them as they plan, develop and secure capital, partners, and off-take for their projects.

Through the guidance of the Queensland Hydrogen Taskforce, the report was commissioned to identify and evaluate each of Queensland's key export regions. It also examines existing infrastructure and its potential role in local supply chains.

Consistent with the expectations of our government, our partners, and proponents, many of Queensland's ports examined can be expanded or adapted to accommodate hydrogen export, and along with other publicly-owned assets, will support good jobs for generations to come.

Work is already in progress in Townsville for example, under the $1.6 billion Port Expansion Project (PEP), with the first phase — a $232 million Channel Upgrade Project — delivering a wider shipping channel that will allow vessels up to 300 metres in length to access the port.

In Gladstone, the port has been working with a number of proponents to facilitate hydrogen in the region. Gladstone Port's future renewables precinct will enable this development, and it is located adjacent to the 27,000 hectare Gladstone State Development Area. The port has already moved more than one million cubic metres of material through a reclamation program to form new port land areas at the Renewables Hub Precinct.

To leverage the opportunities identified, our whole-of-government approach will progress. As outlined in the next steps, the Coordinator-General will serve a critical planning role, working in our state development areas with operators of our state-owned utilities and their partners.

In addition, the valuable information in the report will support the actions outlined in the recently released Queensland Energy and Jobs Plan, with a commitment of up to $15 million to supercharge, coordinate and further plan for hydrogen hubs in key locations across the state.

I look forward to working closely with the energy sector and local communities to ensure Queensland leads the way in green hydrogen and builds on our solid reputation as a global leader in renewable energy, green hydrogen, and job creation.

**The Hon. Mick de Brenni MP**
*Minister for Energy, Renewables and Hydrogen*
*Minister for Public Works and Procurement*

**DNV Hydrogen report 2022 (page 10). Data in Mt/yr H2 consumed.*

# Taskforce Chair's foreword

With the increasing demand for renewable resources, this strategic assessment of the emerging renewable hydrogen industry in Queensland is essential. It recognises the need to balance social, environmental and cultural values for all our communities that rely on a thriving and sustainable economy.

The report provides an important baseline for the Queensland Government to build a transparent and sustainable landscape for renewable hydrogen proponents and the communities in which they will operate. Due to the fast pace at which the renewable hydrogen industry is developing to help meet decarbonisation goals, the release of this report is timely.

As anticipated, the report recognises the opportunity for Queensland to become a major player in the renewable hydrogen export market. Importantly, proponents and communities are now better placed to be informed about the factors that influence development of the hydrogen industry. This is particularly relevant in those regions with greatest potential for development of a hydrogen export market, such as Central and North Queensland.

Notwithstanding the need for domestic supply, the report highlights that careful planning of key infrastructure will be crucial, not only for guaranteeing the feasibility of projects, but also to ensure sustainable benefits for communities located in areas where the industry is likely to develop.

During the development of the assessment, the Queensland Hydrogen Taskforce provided expert strategic advice regarding economic drivers, environmental and social considerations to the Queensland Government. This final strategic assessment provides a holistic synopsis of the factors that influence the hydrogen value chain. It will help to enable the successful growth of a hydrogen industry in Queensland.

This is an exciting time for Queensland, and the Taskforce is looking forward to continuing to support the Queensland Government in fulfilling its vision for a renewable hydrogen sector that provides broad economic and social benefits for Queensland into the future.

**Professor Peta Ashworth (OAM)**
*Queensland Hydrogen Taskforce Chair*
*Director N. Liveris Academy for Innovation and Leadership, University of Queensland*

# Purpose of this report

The Queensland Government has undertaken a state-wide study of Queensland's renewable hydrogen production and export potential. This was led by the Queensland Government's Hydrogen Taskforce and Hydrogen Division, in consultation with a Technical Working Group including key government departments and government-owned corporations. The aim was to better understand Queensland's hydrogen export capacity and the ability for different regions to support a new hydrogen industry. The study also aimed to identify key steps that government needs to take to enable the development of the new industry.

This document is a summary report of the Strategic Planning for Hydrogen Production and Export Facilities study.

# Acknowledgement

This report and its associated materials were researched and produced by Advisian Pty Ltd www.advisian.com leveraging their insights from over 3,000 energy transition projects (locally and globally).


QFleet added five Hyundai Nexo hydrogen cars to its fleet in 2021, featuring distinctive, Indigenous-inspired designer decals. The striking decal design – featuring a hydrogen nucleus and the Brisbane River (Maiwar) – demonstrates the interconnectedness of communities across Queensland and Australia.

# Acknowledgement of country

**Queensland's path to treaty commitment**

With a renewed focus, the Queensland Government, First Nations people and non-Indigenous Queenslanders participated in the signing of the Queensland's Path to Treaty Commitment on the 16 August 2022.

The commitment signifies a collective pledge to be courageous and curious, to be open to hearing the truth of our state's history and to collaborate in readiness for negotiating treaties.

Read Queensland's commitment below.

**A collective pledge**

A collective pledge Aboriginal and Torres Strait Islander peoples have lived on and cared for this land for thousands of years and assert they have never ceded their sovereignty.

In this, the 163rd year of the State of Queensland, the government and Aboriginal and Torres Strait Islander Queenslanders continue our shared commitment to a reframed relationship.

This is a commitment whose time is now. The time to reach out to each other, to understand each other, to grow together and to move together to a unified future where we value, respect and protect each other.

The Path to Treaty is a significant step forward in reframing the relationship with First Nations peoples—a process through which all Queenslanders can recognise Aboriginal and Torres Strait Islander peoples as the first peoples of the land, winds, sky and waters we now share.

This Path to Treaty is a journey, not for the timid, but for those who are courageous to confront our uncomfortable past, the curious who long to find out and live with the truth, and the optimists who dream of the possibilities of a future where we live comfortably with the past, free of blame and rancour because we commit to not repeating those things that shame us.

This journey together will enrich the lives of all Queenslanders and provide for greater recognition, celebration and learning from First Nations peoples.

In Queensland we commit to be courageous, curious and optimistic as we hear the truth and collaborate in maturity to build the consensus necessary to establish treaties, to build a place where the world's oldest living culture of Aboriginal peoples and Torres Strait Islander peoples is celebrated as central to the identity of all Queenslanders.

***Stronger together*** *By Marlie Albert*

# Queensland - the place to be

Queensland is in a good position to build and support the new hydrogen industry thanks to our abundant solar and wind resources, large areas of land, and highly skilled workforce.

Queensland has a unique opportunity to create an internationally significant renewable hydrogen export industry to benefit all Queenslanders, thanks to the state's domestic production capabilities and world-class ports with access to markets in Asia and beyond.

**Highly skilled workforce**
Queensland's workforce is equipped with STEM, trades and technical skills that will support this emerging market.

**Established energy exporter**
Record 23.5 million tonnes of LNG exported from Queensland in 2021-22.

**Manufacturing state**
Queensland's economy is bolstered by manufacturing, including plans to manufacture hydrogen electrolysers in Gladstone.

**Exceptional solar capacity**
Queensland is geographically well positioned to receive sunshine over 300 days of the year.

**Supporting business**
Queensland provides a regime with a strong focus on innovation.

**Proximity to Asia**
Queensland ports are in close proximity to busy Asian industrial hubs.

**Government leadership and investment**
Queensland is making strategic investments through the $35 million Hydrogen Industry Development Fund and the $4.5 billion Queensland Renewable Energy and Hydrogen Jobs Fund.

**Queensland Energy and Jobs Plan**
The Plan allows for the transformation of Queensland's energy system to deliver clean, reliable and affordable energy. This includes outlining how renewable hydrogen can play a key role.


**Queensland's close proximity to Asian markets mean that there are opportunities for multiple regions across the state to support a renewable hydrogen export industry.**



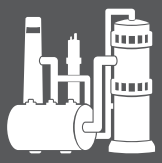
## Benefits for Queensland

Unlocking opportunities associated with renewable hydrogen in Queensland has the potential to deliver thousands of job opportunities, significant investment and economic growth, new infrastructure and emissions reductions.

# What is hydrogen?

Hydrogen is a colourless, odourless non-toxic gas. Today, hydrogen is predominantly produced from fossil fuels and is used in various industries, such as petroleum refining and ammonia production.

## Black/grey hydrogen



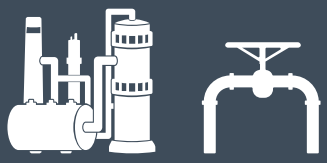
Produced using steam methane reforming (SMR) of natural gas or coal

**Carbon intensity**

0 10

Kg $CO_2$ per kg of $H_2$

## Blue hydrogen



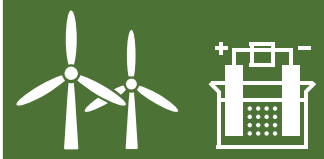
Produced using SMR and carbon capture use and storage (CCUS)

**Carbon intensity**

0 10

Kg $CO_2$ per kg of $H_2$

## Green/renewable hydrogen



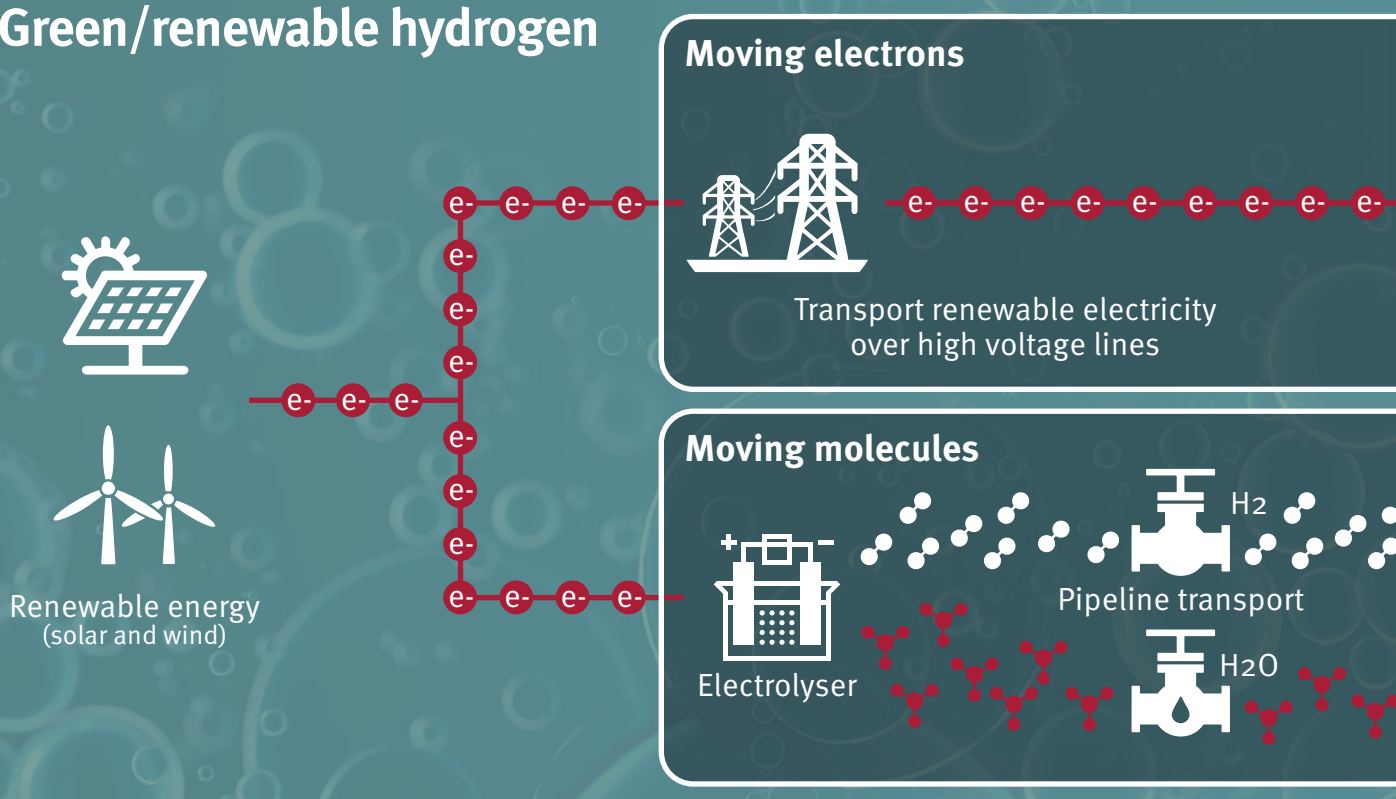
Produced via electrolysis of water using renewable electricity

**Carbon intensity**

0 10

Kg $CO_2$ per kg of $H_2$

## Green/renewable hydrogen



# How is renewable hydrogen created?

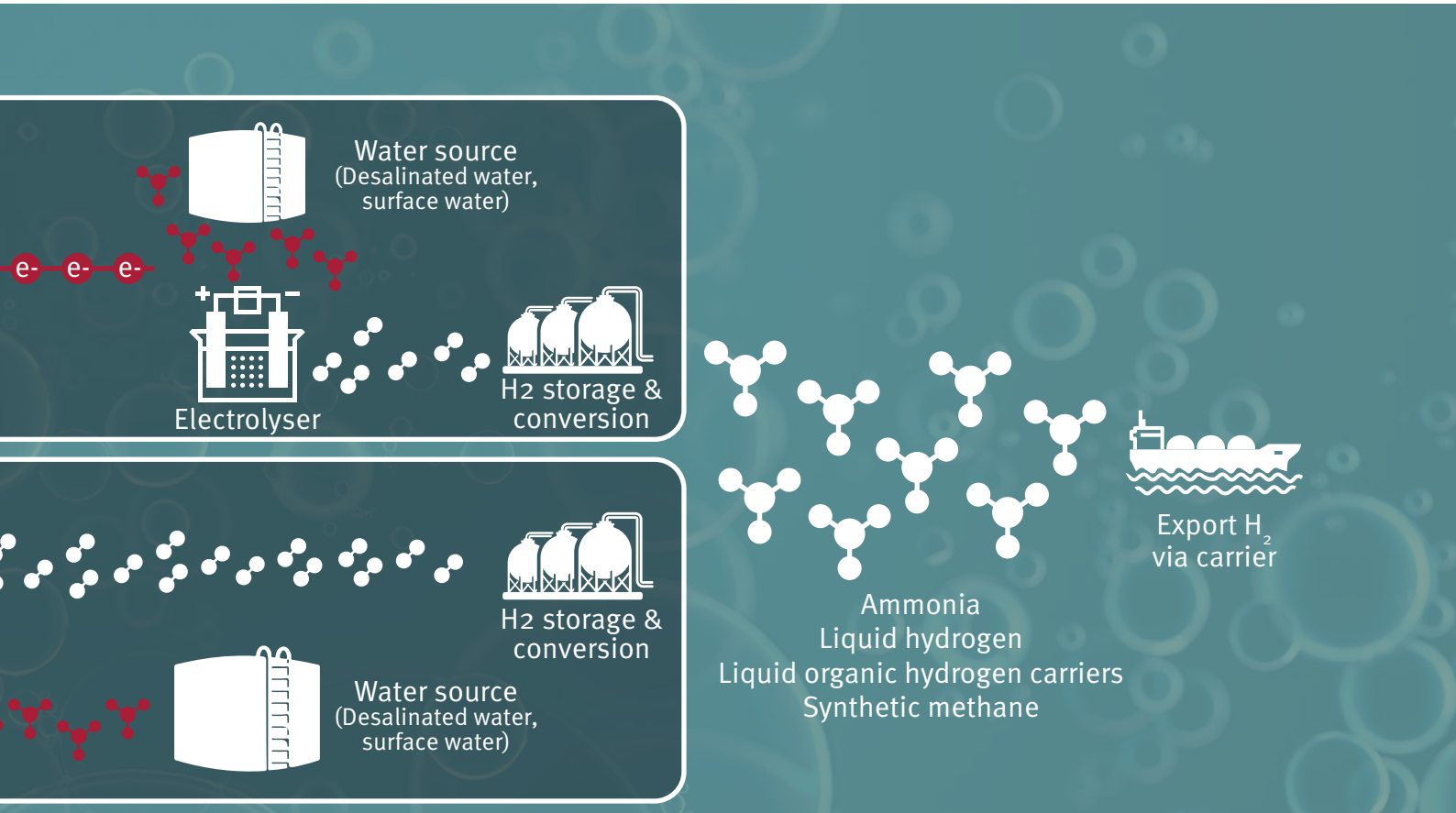
Renewable hydrogen is made through an electrolysis process where water is split into hydrogen and oxygen using renewable electricity in an electrolyser. Renewable hydrogen is currently an emerging industry with significant potential to assist global decarbonisation efforts, primarily driven by the rapid cost reduction experienced by solar and wind over the last decade.

Renewable hydrogen offers the potential to reduce existing fossil-based hydrogen in industrial feedstocks and can act as a long-term storage medium for renewable energy and support industries that are difficult to electrify.

# What is the hydrogen value chain?

The renewable hydrogen value chain is made up of production, transport, carrier conversion and export. Transport can take two forms, namely, moving electrons and moving molecules, the key distinction between the two being the location of the electrolyser:

- When 'moving electrons' the electrolyser is co-located with the carrier conversion facility at the port and renewable electricity is moved as electrons from relatively distant generation sites on powerlines.
- When 'moving molecules', the electrolyser is co-located with the renewable electricity generators. This implies that hydrogen gas is transferred to port in pipelines.



# Hydrogen carriers

To enable export, hydrogen produced in Queensland will need to be converted to higher density products for transportation or use. This is similar to the existing LNG export industry where natural gas is liquified to enable export. In the case of hydrogen a carrier conversion facility is where the conversion takes place, and multiple different carriers can be considered.

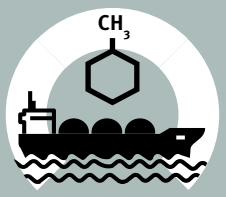

**Liquid hydrogen**

A refrigeration process reduces hydrogen temperature to below -253°C into a liquid form. Regasification is required to enable the end user to utilise the hydrogen.

**Regasification plant**

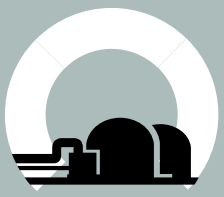

**Ammonia**

Anhydrous ammonia is formed at -33°C where hydrogen molecules are added to nitrogen molecules that are separated from air. One tonne of hydrogen can be converted to approximately 5.6t of ammonia.

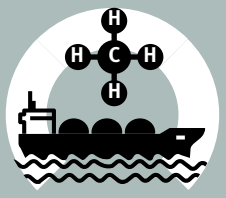



**Liquid organic hydrogen carriers**

Hydrogen is added onto toluene to form methylcyclohexane (MCH), to enable transport as a liquid at ambient temperature. The hydrogen is then unloaded at the destination, and the toluene is returned for reloading. One tonne of hydrogen converts to approximately 16.2t of MCH.



**Carrier unloading plant**




**Synthetic LNG**

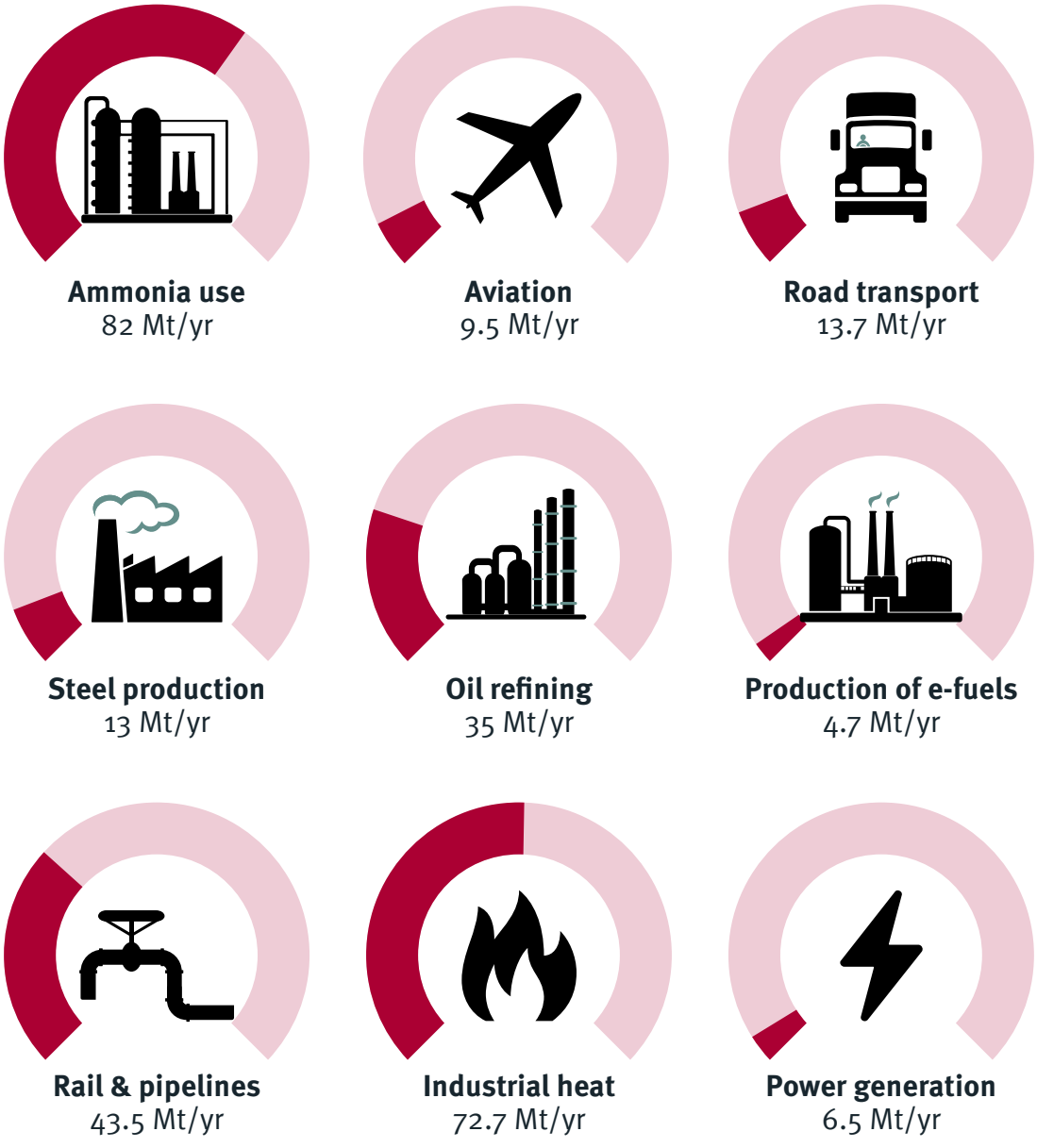
Hydrogen is combined with carbon from carbon dioxide to form methane, that can be liquified at -161°C in new or existing LNG facilities. Approximately four tonnes of methane can be produced from one tonne of hydrogen.

**Regasification plant**

# Hydrogen end-use sectors

Hydrogen is a versatile fuel that is able to support a multitude of industries and sectors and will play an important role in the energy transformation both domestically and internationally, allowing export partners to achieve their decarbonisation targets.

# Forecast global demand by 2050




***Source:*** *DNV hydrogen report 2022. Data in Mt/yr H2 consumed.*


# All of Queensland

In 2020, the Queensland Government committed $145 million to establish three Queensland Renewable Energy Zones (QREZ) in northern, central, and southern Queensland. The Australian Energy Market Operator (AEMO) has identified candidate renewable energy zones (REZ) within these large QREZ areas, which have favourable solar and wind conditions, including available land for development of renewable energy facilities (discussed further in this report).

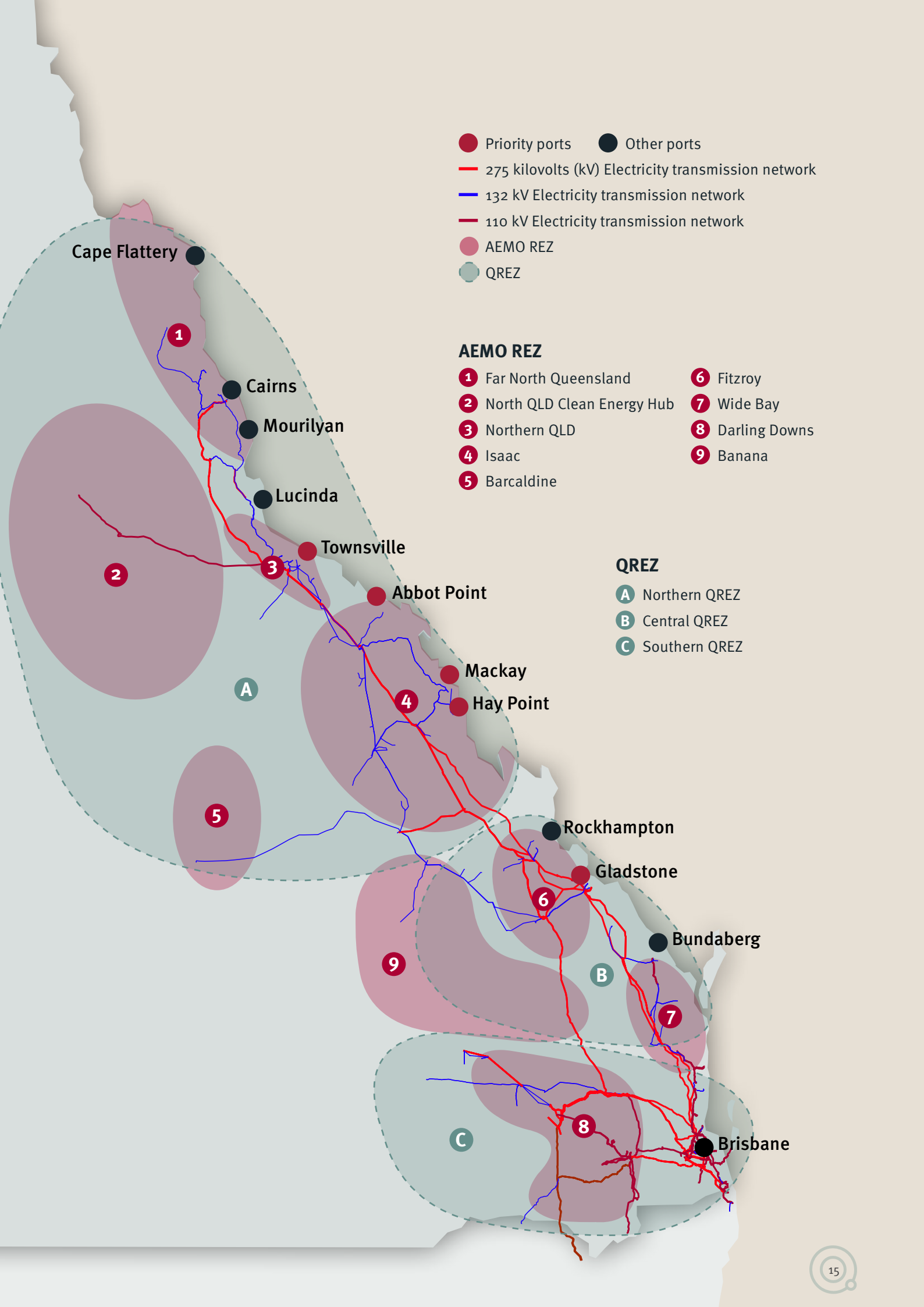
The REZs are located in regional areas and will need to be connected to the ports through powerlines and pipelines via new and existing corridors. REZ capacity will also be required to support domestic decarbonisation up to 2050, with remaining capacity potentially available for hydrogen production.

Hydrogen production requires a reliable supply of water. Unallocated surface water availability is generally higher in the north of the state, which can be unlocked through the development of water infrastructure such as storage and pipelines. Desalination of seawater could supply the forecast water requirements of a large-scale hydrogen export industry and ensure the sustainable management of water resources to meet the current and future water needs of the community.

Key constraints and opportunities at 14 of Queensland's ports have been identified, and detailed assessments were completed on four priority ports. The assessment considered nearby REZs, water resources, available land within the REZs, corridors and land near the port as well as port capacities to ultimately determine the region's hydrogen production and export through capacity. The regional hydrogen production capacities (presented further in this document) determined are not additive to the state hydrogen potential, as in some cases multiple regions rely on the same renewable energy zones.

Priority ports, such as Townsville, Abbot Point, Mackay/Hay Point and Gladstone are the most favoured export ports. This is due to close proximity to REZs, available land and the availability of berths, suitable shipping channels and potential for port expansion via capital dredging projects. These regional centres also possess the necessary supporting infrastructure and transferrable skills to support and grow the new industry.

A more detailed assessment was completed on the priority port regions to identify constraints and opportunities. The remaining port regions were assessed more broadly.


Priority ports
Other ports
275 kilovolts (kV) Electricity transmission network
132 kV Electricity transmission network
110 kV Electricity transmission network
AEMO REZ
QREZ
AEMO REZ
1 Far North Queensland
2 North QLD Clean Energy Hub
3 Northern QLD
4 Isaac
5 Barcaldine
6 Fitzroy
7 Wide Bay
8 Darling Downs
9 Banana
QREZ
A Northern QREZ
B Central QREZ
C Southern QREZ
Cape Flattery
Cairns
Mourilyan
Lucinda
Townsville
Abbot Point
Mackay
Hay Point
Rockhampton
Gladstone
Bundaberg
Brisbane

# Simplicity in complexity

## Key requirements for a hydrogen export industry

**Energy**

Solar and wind resources within the REZ need to be shared with domestic decarbonisation, especially in regions with large domestic industrial and residential demand.

Further competition will include energy storage in the form of pumped hydro and battery storage systems which will be required to provide firming of the variable renewable energy supply.

**Water**

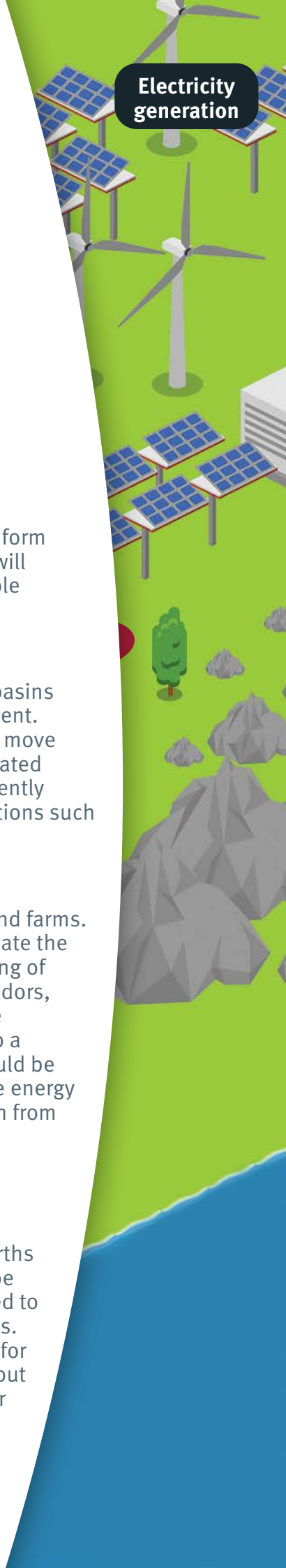
Water will need to be sustainably sourced from local basins without impacting local water users and the environment. In each region, this will require water infrastructure to move water from the source to the electrolyser facilities, located inland or near the coast. Further planning work is currently being undertaken around future bulk water supply options such as desalination and freshwater.

**Land**

Land within each REZ will be required for solar and wind farms. Queensland has suitable land available to accommodate the required hydrogen production at export scale. Widening of established electricity transmission and pipeline corridors, including new corridors should be factored into future regional planning to enable the energy to be moved to a port. Land near the port is the most valuable and should be prioritised for hydrogen facilities instead of renewable energy facilities, while also maintaining necessary separation from neighbouring land.

**Ports**

A port's ability to accommodate hydrogen export will depend on its ability to accommodate large ships. Berths can be expanded and repurposed or new berths can be established through dredging. Shipping channels need to be deep and wide enough to accommodate large ships. Queensland's priority ports are able to seek approval for capital dredging projects. Alternatively, offshore loadout and extended jetties can also be used to reach deeper waters.

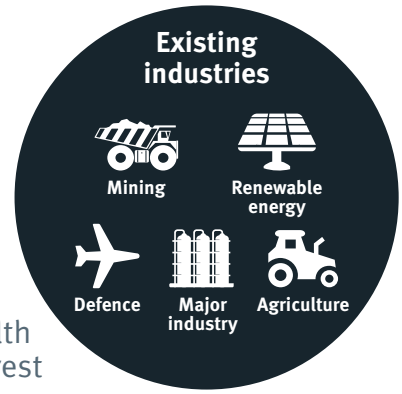


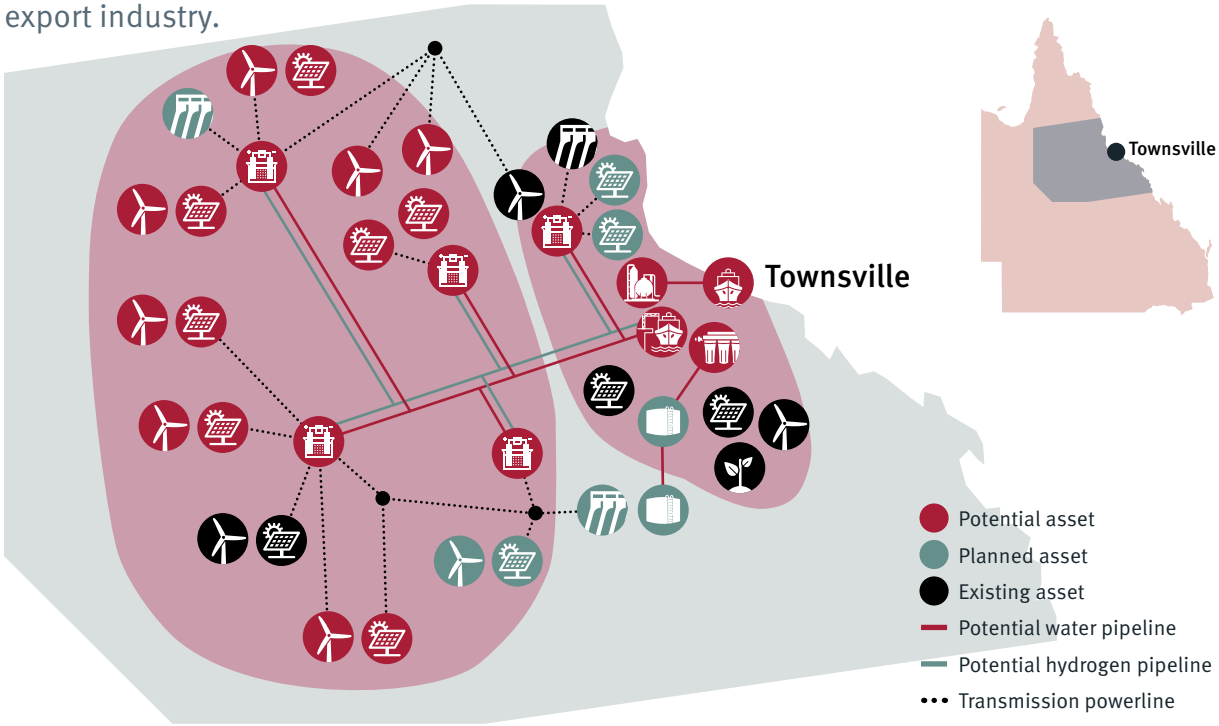

Water source
Electricity storage
Electrolyser
Electricity transmission corridors
Great Dividing Range
Electrolyser
Pipeline transmission corridors
Desalination facilities
Carrier production & storage
Berth infrastructure
Shipping channels
NOT TO SCALE

# Regional potential

## Townsville

Townsville has traditionally supported various agriculture and defence industries and minerals export including industrial engineering and construction sectors. Townsville has been identified as a hydrogen hub by the Commonwealth Government and early movers have already expressed interest in the Townsville region to develop a renewable hydrogen export industry.




**1.15 Mtpa (million tonnes per annum)#** hydrogen production based on renewable energy capacity

**24.3 GW (gigawatts)*** of renewable energy capacity

**23-53 GL (gigalitres)** of water required per year

North Queensland and North Queensland Clean Energy Hub REZs have significant solar and wind resources and the potential to produce large quantities of hydrogen.

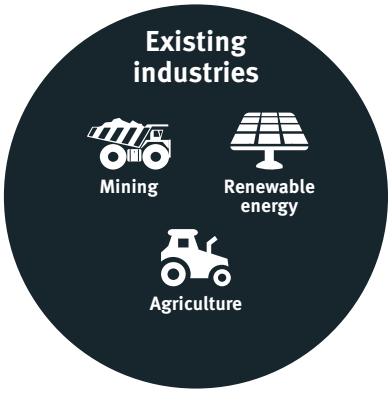
Burdekin Basin has the potential to supply quantities of surface water that will require the development of new infrastructure.

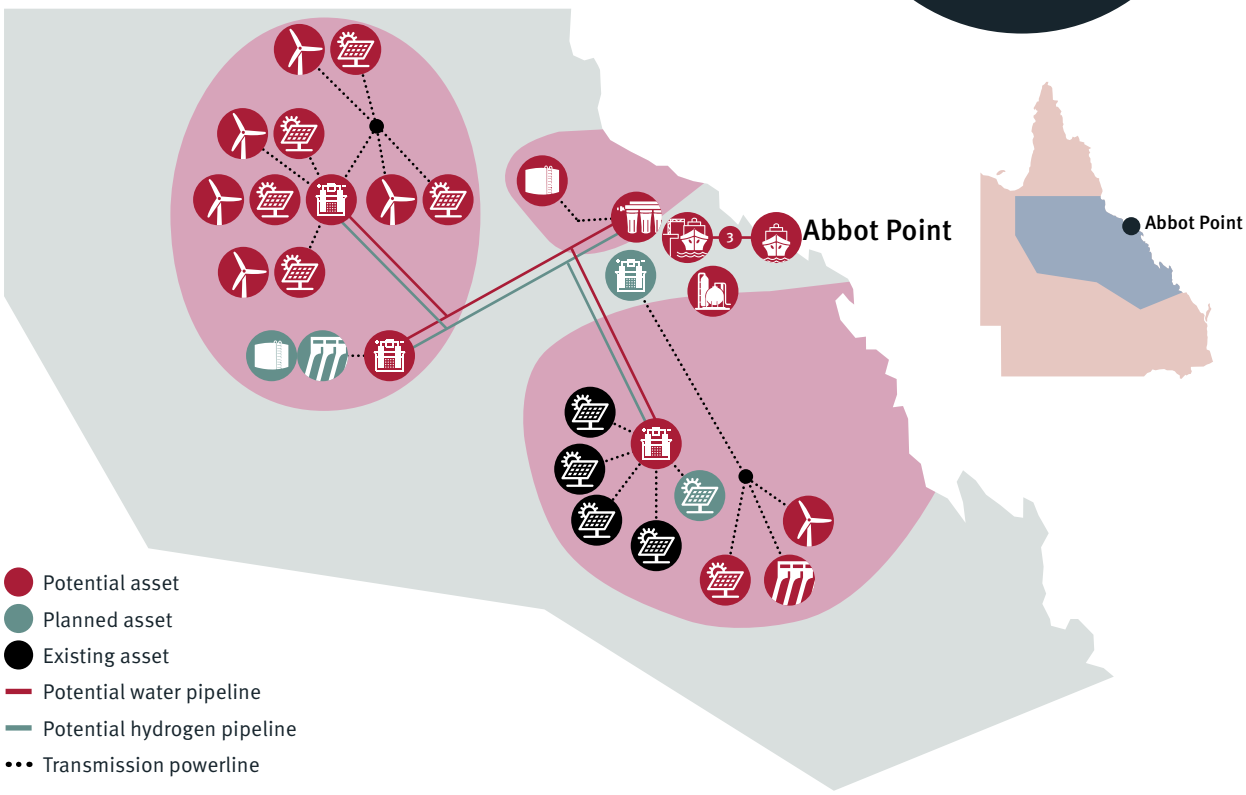
The Townsville State Development Area (SDA) is located close to the port however, land availability is constrained for large projects. The Lansdowne Eco-precinct, west of Townsville provides an opportunity to accommodate hydrogen facilities.

The Port of Townsville is undergoing channel widening and land reclamation that will unlock new land for carrier storage facilities.

# Abbot Point

The Port of Abbot Point is located approximately 20 km north-west of Bowen and is a suitable location for industrial and port-related development. It is Australia's most northern coal export port and is in naturally deep water.




**1.38 Mtpa#** hydrogen production based on renewable energy capacity

**30.6 GW*** renewable energy capacity

**29-69 GL** of water required per year

Abbot Point is located close to the Isaac and Northern Queensland REZs and within 400 km from the North Queensland Clean Energy Hub REZ. The three REZs have excellent solar and wind capacity potential, to support a large hydrogen scale export industry.

The Burdekin Basin does have unallocated water that could support the initial scale up of the industry, subject to the development of new water infrastructure. Desalination options may also need to be considered.

The Abbot Point State Development Area (SDA) is close to the port and has sufficient land availability to accommodate hydrogen production and carrier conversion facilities.

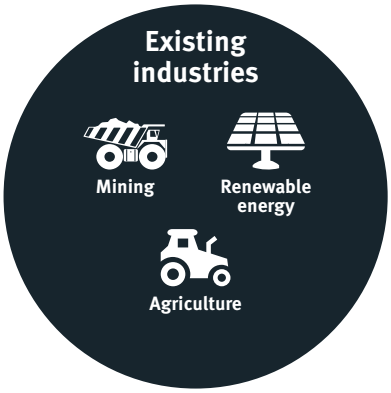
The Port of Abbot Point currently exports a single commodity, coal, with large opportunities for expansion, including the option to undertake further capital dredging for additional berths if required.

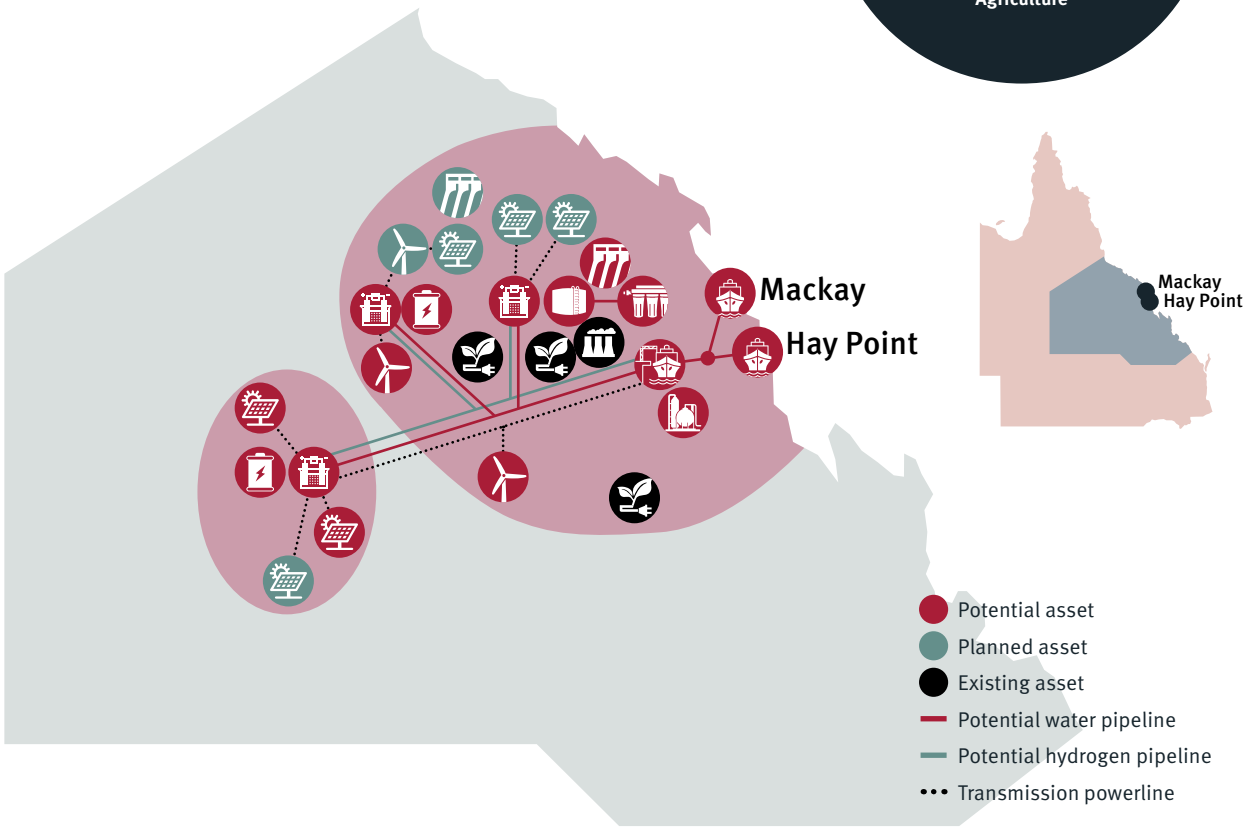
**Renewable energy capacity does not include capacity committed to the NEM up to 2050.*

*# Values represent hydrogen production possible in each region and are not intended to be a cumulative representation of Queensland's total renewable hydrogen potential.*

# Mackay/Hay Point

The region has two ports - Mackay trades commodities including grain and sugar, while Hay Point is a larger port with two metallurgical coal terminals.
The region has a large skilled workforce supporting the coal and agricultural industries.




**0.78 Mtpa#** hydrogen production based on renewable energy capacity

**20.8 GW*** of renewable energy capacity

**15-36 GL** of water required per year

The Isaac renewable energy zone, is within the vicinity of both ports and has solar and wind capacity potential. Expansion towards the Barcaldine REZ is also possible to access an additional solar resource to support a large-scale export industry.

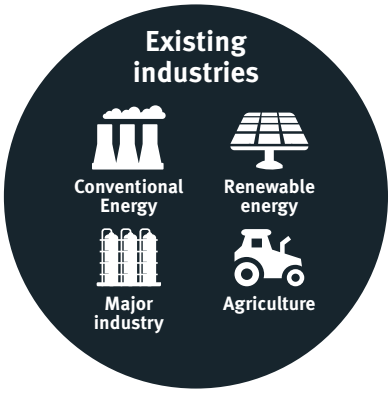
The Burdekin and Fitzroy basins have volumes of unallocated water that may be able to support the industry subject to the development of new water infrastructure.

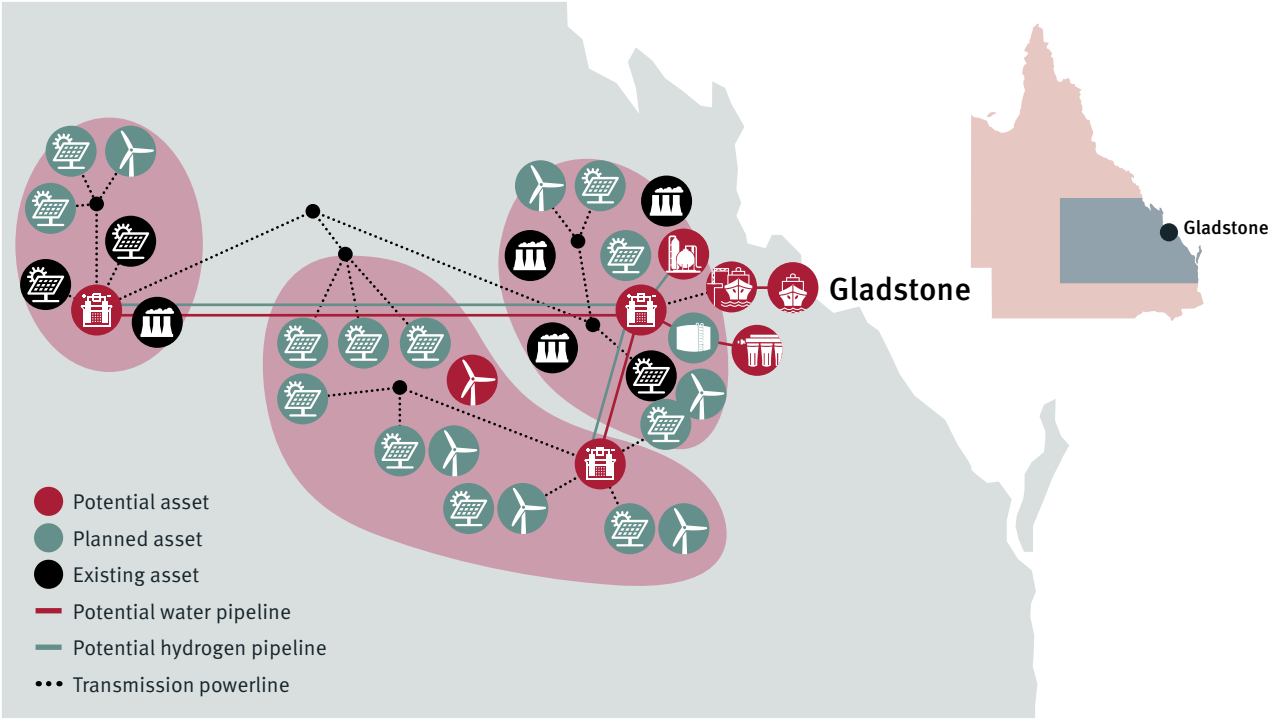
The land near the Mackay port is limited and constrained, while Hay Point has sufficient land available to accommodate carrier conversion facilities near Dudgeon Point.

The Port of Hay Point can accommodate large vessels and has potential for expansion to accommodate hydrogen export.

# Gladstone

Gladstone is an established industrial centre with existing export facilities including LNG, coal and aluminium smelters. The region has a large workforce with transferable skills to build and support the industry.




**0.61 Mtpa#** hydrogen production based on renewable energy capacity

**16 GW*** of renewable energy capacity

**9-22 GL** of water required per year

Fitzroy and Banana REZs have excellent solar and wind capacity potential, which will need to contribute to domestic decarbonisation, requiring expansion towards the Barcaldine REZ to support a large scale export industry.

Planning to meet the initial forecast water requirements of the emerging hydrogen industry in this region is under way, including the Fitzroy to Gladstone Pipeline. In the long-term, significant new sources and infrastructure will be required, likely including desalination.

The Gladstone State Development Area (SDA) north of Gladstone is located close to the port and has sufficient land availability to accommodate hydrogen production and carrier conversion facilities.

The Port of Gladstone is one of Australia's busiest ports with significant growth potential. It has a number of existing berths that could be repurposed for hydrogen, including approval to undertake further capital dredging.

**Renewable energy capacity does not include capacity committed to the NEM up to 2050.*

*# Values represent hydrogen production possible in each region and are not intended to be a cumulative representation of Queensland's total renewable hydrogen potential.*

# Weipa

Weipa is one of the largest centres on the Cape York Peninsula, and compared to all the regions assessed, is the closest to markets in Asia and beyond. The region has an established workforce supporting bauxite mining operations.

**Existing industries**

Mining

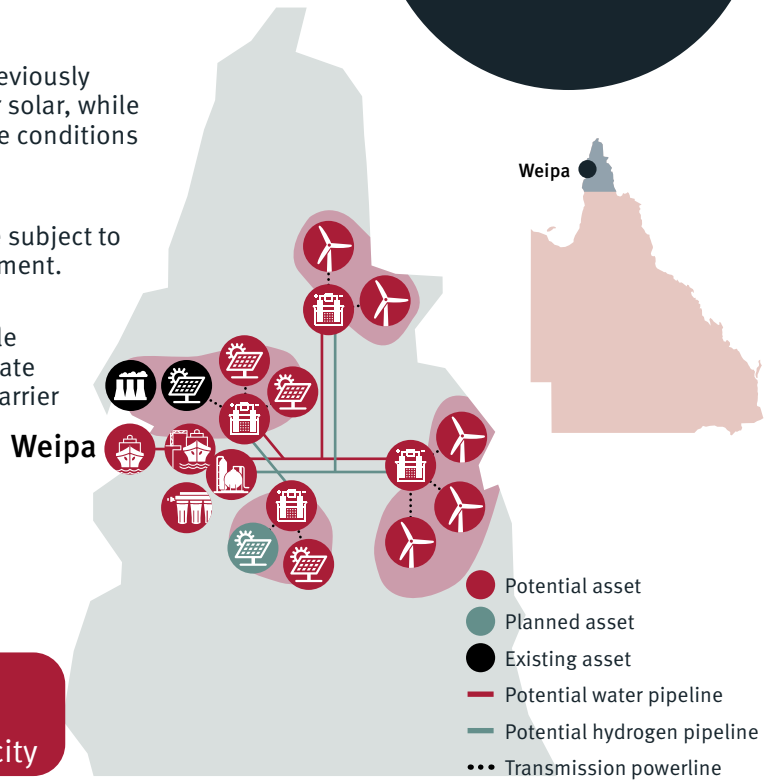
Defence

Remote from REZs, local previously mined land can be used for solar, while some areas have favourable conditions for wind energy.

Unallocated water could be subject to new infrastructure development.

Large areas of land available near the port to accommodate hydrogen production and carrier conversion facilities.

Port able to accommodate large vessels, with room for expansion.




**0.50 Mtpa[#]** hydrogen production based on renewable energy capacity

# Karumba

Karumba is a remote town and port located in the Gulf of Carpentaria, supporting zinc export, fishing, tourism and cattle raising industries.

**Existing industries**

Mining

Fishing

Agriculture

Closest REZ is North Queensland Clean Energy Hub, with limited existing transmission infrastructure to connect to REZ.

With highly seasonal water supply and limited water infrastructure, significant investment would be required.

Large areas of private land available near port of Karumba.

Shipping channel is depth constrained, only suitable for flat barges, meaning transhipping or offshore load out will be required for export.

**1.06 Mtpa[#]** hydrogen production based on renewable energy capacity

*[#] Values represent hydrogen production possible in each region and are not intended to be a cumulative representation of Queensland's total renewable hydrogen potential.*

# Cape Flattery

Cape Flattery is a remote port, located approximately 250 km north of Cairns and within the Cape York Peninsula Heritage Area. The region and port is currently serving one industry which is the mining and processing of silica for export.

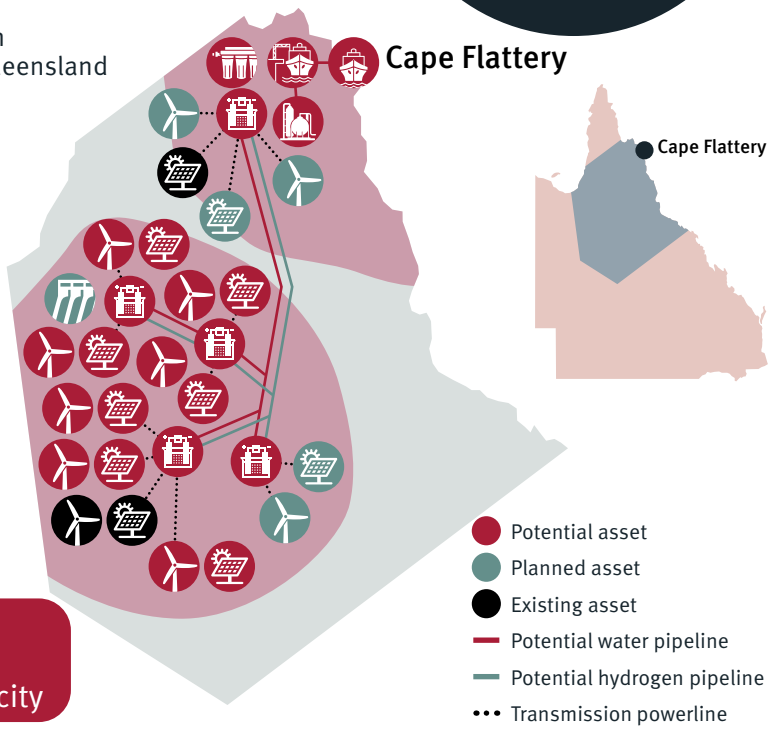

Located near the Far North Queensland and North Queensland Clean Energy Hub REZs.

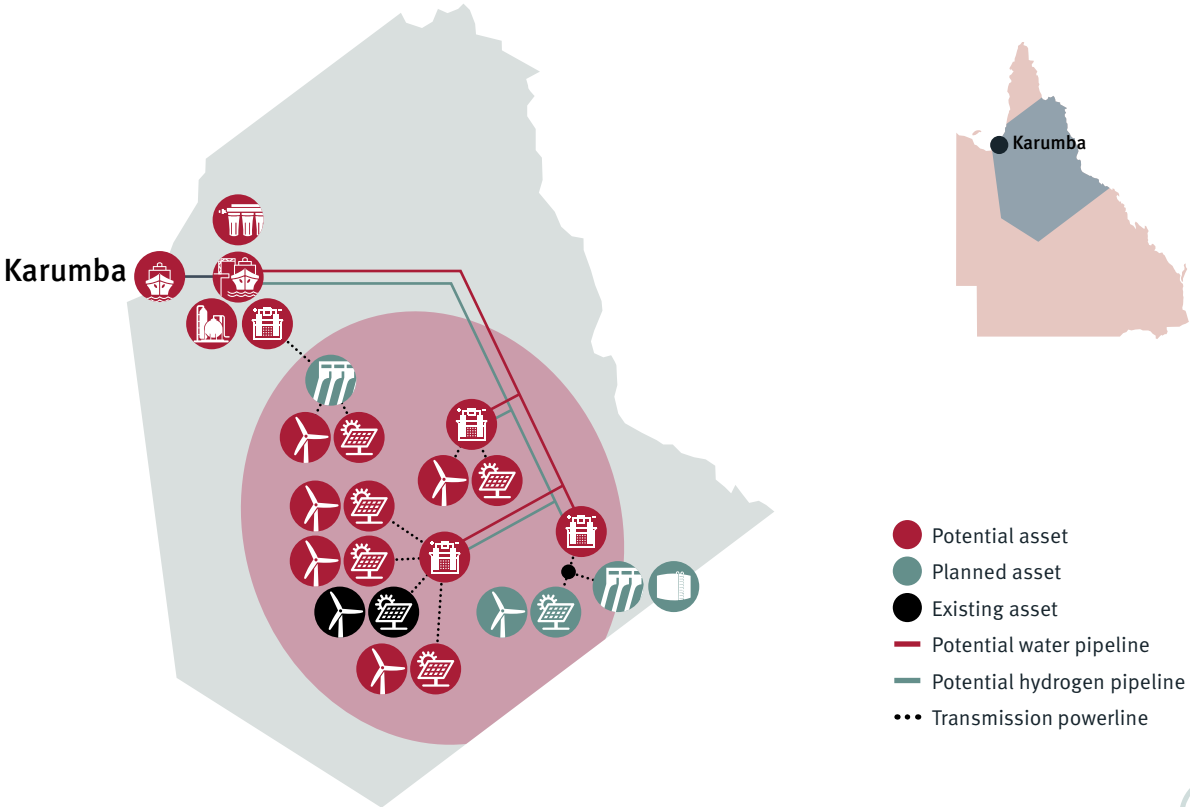
Small quantities of unallocated water.

Large areas of land available near the port on mine land.

Port limited to smaller vessels, limited expansion potential as not a priority port.

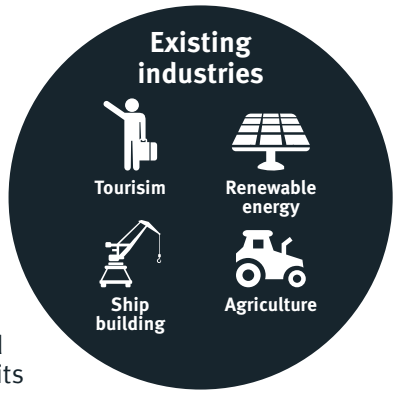
**1.1 Mtpa#** hydrogen production based on renewable energy capacity



# Cairns

Cairns is the 9th largest local government area in the state in terms of population and is highly dependent on the tourism industry, particularly for the Great Barrier Reef Marine Park (GBRMP).



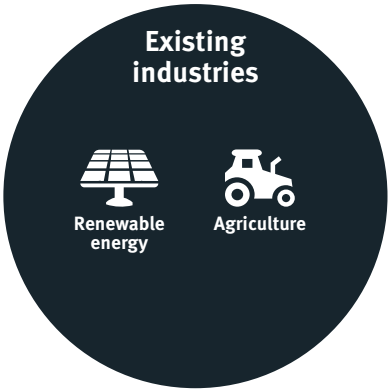

The Great Dividing Range is located close to the coast and there are world heritage listed rainforest areas, which limits renewable energy capacity. Land near the port is limited due to land availability and constrained due to close proximity to the CBD. Alternative land near Ellie Point could be considered for small scale development.

New berths off Ellie Point would be required, including dredging of new shipping channels.

**1.06 Mtpa#** hydrogen production based on renewable energy capacity

# Lucinda

Lucinda is a small town about 100 km north of Townsville, and the primarily industry is the export of sugar cane.




Lucinda is surrounded by national parks and state reserves, and land near the port is limited due to large areas of sugar cane cropping.

Port scale is limited to smaller vessels, and expansion is limited as Lucinda is not a priority port.

**1.19 Mtpa#** hydrogen production based on renewable energy capacity

All three regions are close to the Far North Queensland, Northern Queensland and North Queensland Clean Energy Hub REZs. These three zones combined have significant renewable energy capacity.

All three regions are within the Wet Tropics Water Plan area, which has a highly seasonal water supply and large volumes are already allocated.

# Mourilyan

The Port of Mourilyan is located 10 km south of Innisfail, and 90 km south-east of Cairns, in the Cassowary coast region of Queensland.

**Existing industries**

Renewable energy

Agriculture

Port is surrounded by state reserves and is susceptible to sea level rise flooding, limiting locations for potential hydrogen facilities.

Port is limited by ship draught, and significant dredging will be required for larger carrier ships to enter the port.

**1.19 Mtpa[#] hydrogen production based on renewable energy capacity**





- Potential asset
- Planned asset
- Existing asset
- Potential water pipeline
- Potential hydrogen pipeline
- Transmission powerline

*[#] Values represent hydrogen production possible in each region and are not intended to be a cumulative representation of Queensland's total renewable hydrogen potential.*

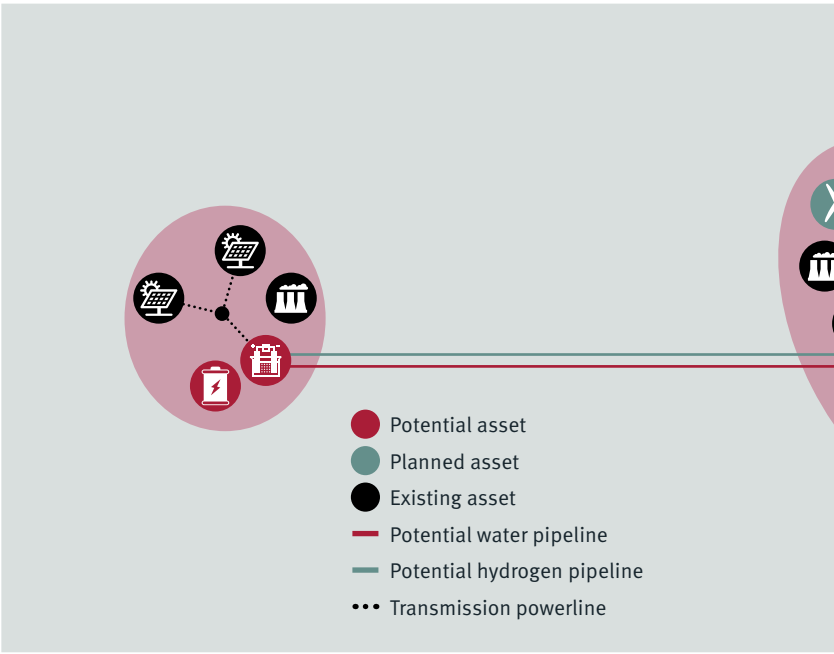
# Rockhampton

Rockhampton is located approximately 130 km north of Gladstone and is a large industrial and agricultural hub for Central Queensland. The Port of Rockhampton is located about 60 km south-east of Rockhampton and currently handles ammonium nitrate and tallow.


Land around Rockhampton is predominantly used for agriculture. Land near the port is sufficient to accommodate hydrogen facilities, but is susceptible to flooding.

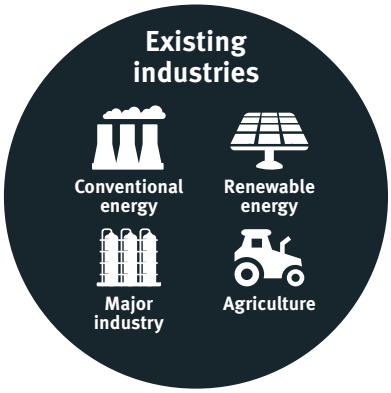
Port can accommodate limited ship sizes, significant capital dredging required to create new berths and a deeper shipping channel.

**0.61 Mtpa**[#] hydrogen production based on renewable energy capacity




# Brisbane

Brisbane is the capital of Queensland, the state's largest population centre. Brisbane, and its surrounds in South East Queensland, is a major demand centre served by the Southern Queensland grid.




Closest REZs are Wide Bay and Darling Downs which are fully committed to domestic decarbonisation. Excess renewable electricity could be used for domestic hydrogen production.

Limited water available due to existing and large demand base.

Corridors for linear infrastructure are heavily constrained due to housing density. Land near the port is sufficient due to the reclaimed land (Fisherman's Island).

Port can accommodate larger vessels, however new berths required on Fisherman's Island will require significant dredging.

Domestic hydrogen production possible using excess renewable electricity

*[#] Values represent hydrogen production possible in each region and are not intended to be a cumulative representation of Queensland's total renewable hydrogen potential.*

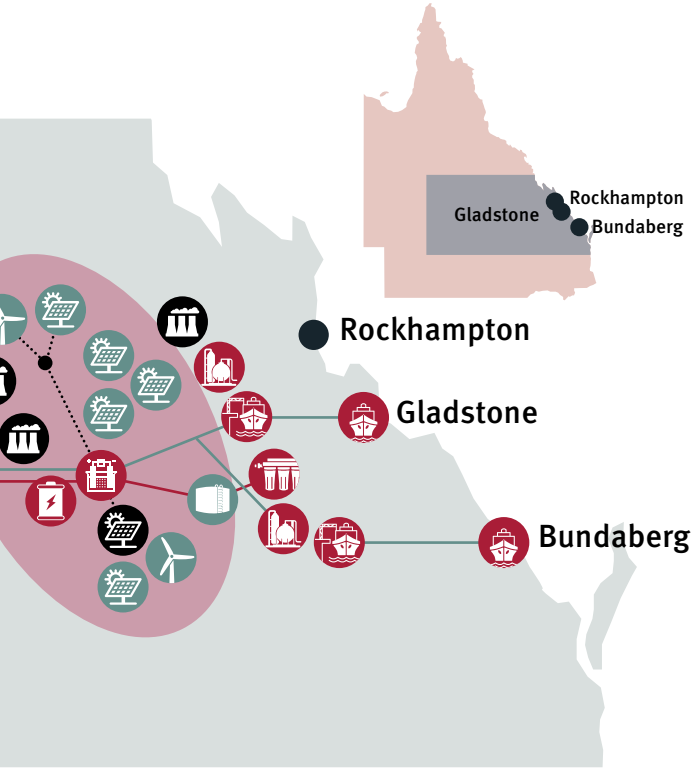
# Bundaberg

Bundaberg is located in the Wide Bay Burnett Region in Central Queensland and is well known for its sugar mills and distilleries. The Port of Bundaberg is located 19 km from the city centre and handles sugar, molasses and both bulk and liquid cargoes.

**Existing industries**

Renewable energy

Agriculture




The Fitzroy, Banana and Wide Bay are closest REZs, however are heavily committed to domestic decarbonisation.

To achieve export scale expansion towards Barcaldine will be required.

Unallocated water from Fitzroy Basin can provide water required for industry depending on the scale of new infrastructure development.

Bundaberg SDA has sufficient land available to accommodate hydrogen facilities.

Port limited to smaller vessels, limited by draught.

**0.17 Mtpa#** hydrogen production based on renewable energy capacity

# Growing a Hydrogen industry

Decarbonisation of the higher energy demand centres in south east and central Queensland will require a high reliance on the Fitzroy, Banana, Wide Bay and Darling Downs REZs. This means that renewable energy for hydrogen production and export will be more reliant on the central and northern REZs and this will result in energy flows from north to south (which is reversal of current energy supply system flows). Ultimately, careful planning aligned across all levels of government and industry will ensure that the state can meet its decarbonisation targets while also supporting the growth of the new hydrogen export industry.

Further expansion of the inland renewable energy zones will be a key driver to significantly expand the scale of the industry. Queensland generally has sufficient port-managed land at priority ports to support hydrogen export carriers if land is allocated efficiently.

Queensland's water management framework aims to sustainably share water between different users and is underpinned by comprehensive consultation and science. Planning is underway on how to best meet the significant water requirements of the emerging hydrogen industry, with a focus on climate-independent bulk water sources including desalination options.

# A staged industry scale up approach

## 3000 x growth on currently installed

**<0.01 GW**

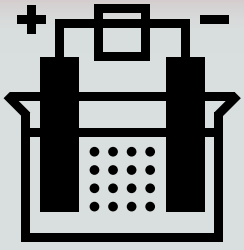
**Current operating electrolyser capacity in Australia**

**0.3 GW**

**Phase 1 of planned hydrogen production facility plant in QLD**

**3.0 GW**

**Example scale of export project**

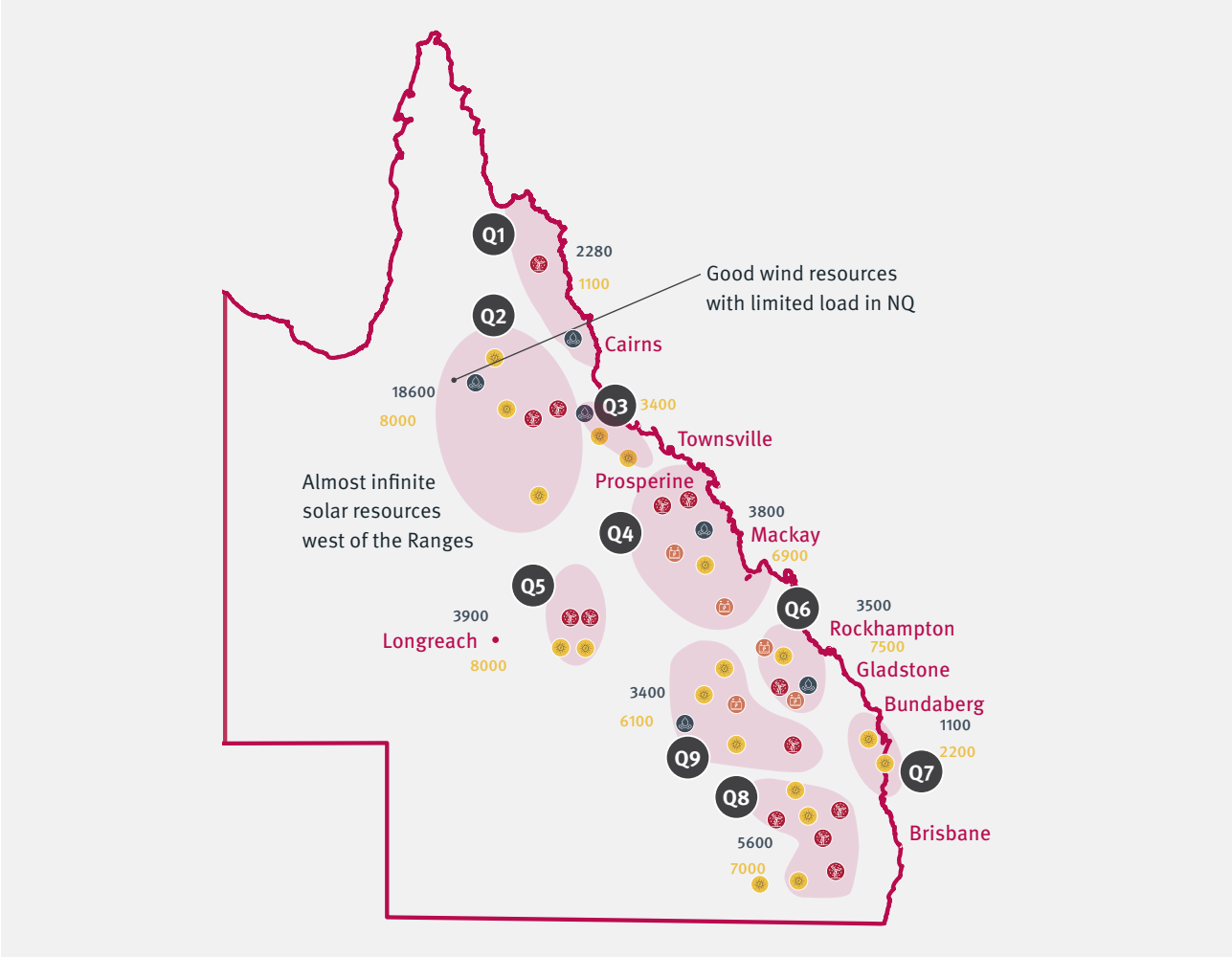


**30 GW**

**Scale to consider in this assessment for regions with multiple projects**

Represents an electrolyser

**Queensland has sufficient renewable energy capacity to support domestic decarbonisation while also growing a hydrogen industry that can support multiple regions.**




*Renewable energy opportunities for hydrogen loads. Yellow numbers indicate potential solar resources, blue numbers indicate potential wind resources.*

*This is referenced on page 50 of the Queensland SuperGrid Infrastructure Blueprint.*

Initially, first movers may look to leverage existing infrastructure to limit initial capital investment, such as using spare electricity grid capacity to move electrons to an electrolyser. Benefit can also be drawn from existing industries such as skills and commercial relationships.

Common user infrastructure, staged to match utilisation and regional demand can be a key enabler to expand the industry from small scale to export scale.

Collaboration between developers can help build the scale needed to deliver common user infrastructure. Common user infrastructure can also result in improved safety aspects, environmental impact minimisation and improvements in social perception and broader sharing of social benefit. These opportunities exist across all infrastructure classes including water infrastructure, energy transport, carrier conversion and storage and berth infrastructure.

# What next?

## Regulatory settings

The Queensland Government is reviewing regulatory settings by ensuring state-based legislation is fit for purpose and will introduce necessary changes to the Queensland Parliament as part of a Hydrogen Bill. Resources Safety and Health Queensland is developing a Hydrogen Safety Code of Practice and risk-based safety regulation that will support a sustainable and safe Queensland hydrogen industry.

## Industry workforce roadmap

The Queensland Government has launched the Hydrogen Industry Workforce Development Roadmap 2022-2032 to build a pipeline of skilled, hydrogen-ready workers. This roadmap is the first dedicated workforce development plan for the industry in Australia and sets a path to a strong and adaptable workforce for a safe and thriving Queensland hydrogen industry.

## Supply chain development

The Queensland Government is working with proponents on the development of a supply chain, such as the Gladstone electrolyser manufacturing facility, while other capabilities such as renewable energy components, hydrogen buses and refuelling facilities are continuously encouraged. The Queensland Advanced Manufacturing 10-Year roadmap and Action Plan released in 2018 identified hydrogen and renewable energy as future manufacturing opportunities.

## Water planning

Given the significant volume of long-term and secure water required for hydrogen production, supply options need to be understood and explored. The government is currently assessing the feasibility of desalinated water for use in hydrogen production in Queensland.

## Renewable energy zone planning

Long-term development of REZ will be complex and needs to support existing industries and emerging opportunities like the hydrogen economy. This will be achieved through coordinated development to support reliable, secure and affordable energy supply to reach Queensland's target for 50% renewable energy by 2030. The government is working with Powerlink and other state-owned utilities, to identify strategic investments aligned to areas of high investor interest.

## Queensland Energy and Jobs Plan

The Plan details how the government will achieve the renewable energy targets and secure a clean, reliable and affordable future for Queenslanders. Opportunities arising from the next wave of renewable projects will create thousands of jobs and provide benefits for local communities, workers and our economy.

## Industry planning

Building on the work of this report, the government will commit up to $15 million to supercharge, coordinate and further plan for hydrogen hubs in key locations across the state.

This work will cover the full value chain, considering key inputs of water and energy, pipelines, storage facilities, and port planning.

This will also include working with stakeholders in existing and new potential hydrogen hub locations to conduct integrated and detailed planning to propel the state into a renewable hydrogen powerhouse.

## Enabling industry

The $4.5 billion Queensland Renewable Energy and Hydrogen Jobs Fund allows energy government-owned corporations to increase ownership of commercial renewable energy and hydrogen projects, as well as supporting infrastructure, including in partnership with the private sector. The government released Queensland's Zero Emission Vehicle Strategy 2022-2032 and the first Zero Emission Vehicle Action Plan 2022-2024. This strategy is accelerating Queensland toward a cleaner, greener transport future while making sure our energy network supports the transformation to zero emission vehicles.

## Regional interconnectivity

A hydrogen industry at scale could be significant in size, providing opportunities for a number of regions and potentially delivering a critical mass to unlock new areas around Barcaldine and towards Hughenden.

The Hydrogen Industry Development Fund was established to drive investment and accelerate development of hydrogen projects in Queensland. Funding has been allocated to projects featuring a variety of domestic renewable hydrogen applications, such as transport, gas-blending, off-grid storage and wastewater treatment.

## Awareness and collaboration

The Queensland Hydrogen Taskforce has been established to focus on delivering a globally attractive destination for hydrogen investment. The government also maintains a regional presence through state development regional offices,allowing government to work closely with hubs/clusters and councils in aiding the progression of industry.

Up to $5 million will be invested to rollout a hydrogen awareness program over three years to inform communities about the uses and benefits of hydrogen.

Images (L to R):
Mount Emerald Wind Farm.
Kidston solar project.
Photo courtesy of Genex Power.

# More information

Access to the Strategic Planning for Hydrogen Production and Export Facilities study can be requested through the Department of Energy and Public Works. Please contact **hydrogensecretariat@epw.qld.gov.au**

For more information please visit:

www.epw.qld.gov.au/hydrogen/qld

www.statedevelopment.qld.gov.au/industry/priority-industries/hydrogen-industry-development

The Department of Energy and Public Works

**www.epw.qld.gov.au**