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Australian Energy Market Operator
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To whom it may concern,

Consultation on AEMO Draft ISP 2024

Energy Estate (EE) welcomes the opportunity to comment on the Australian Energy Market Operator's (AEMO) Draft 2024 Integrated System Plan (ISP).

About us

EE is an independent Australian developer of large-scale energy transition projects and accelerator of other energy transition opportunities across Australia, New Zealand and internationally. We are developing and participating in projects in most states within the NEM.

More specifically, EE is actively pursuing several global-scale development activities in the Queensland region, including:

- *Central Queensland Power*, a 2GW hub in Central Queensland in part in collaboration with CleanCo (the Queensland Government owned generator)[1];
- *HyNQ (Hydrogen North Queensland),* a $7 billion HyNQ Clean Energy Hydrogen Project together with its development partners CS Energy, Idemitsu and IHI Corporation at the Port of Abbot Point – a project that alone is likely to support the development of approximately 2.5GW of renewable energy in North Queensland[2] (HyNQ);
- Large-scale (GW scale) renewable energy projects in North Queensland; and
- Large-scale "sustainable aviation fuels" project in North Queensland.

We are developing large-scale projects in NSW (New England REZ) and were the initial proponents (subsequently incorporated into the 2022 ISP) of grid augmentation from Liddell to Uralla.

The key thesis underpinning our projects is the focus on decarbonisation of heavy industry, either through the supply of dispatchable renewable energy or downstream "green" fuels (hydrogen, ethanol, methanol and SAF). In doing so, we are focused both on the domestic and international markets, with our largest project focused on the export of green ammonia from the Port of Abbot Point, some 200km south of Townsville.

Recommendation: Copperstring and Queensland Super-Grid North – Abbot Point Spur

We note the proposition in the 2024 draft ISP that the "Copperstring" project is scheduled for development by June 2029, while the "Queensland SuperGrid North" is subject to future ISP projects requiring further refinement.

We recommend that the 2024 ISP include planning for a material spur-line from the existing Strathmore substation on the current 275kV network in North Queensland (proximate to Collinsville and the center of the proposed Collinsville REZ) directly to the Port of Abbot Point.

[1] https://www.centralqueenslandpower.com.au/
[2] https://hynqcleanenergyproject.com.au

That may:

- *initially, be a high capacity dual-circuit 275kV line (purple line in Figure 1) or*
- *should be planned as a 500kV line, connecting either into the eastern end of Copperstring (itself likely to be 500kV) or into an accelerated partial build-out of the Queensland SuperGrid North 500kV backbone from to Strathmore Substation (blue line in Figure 1),*

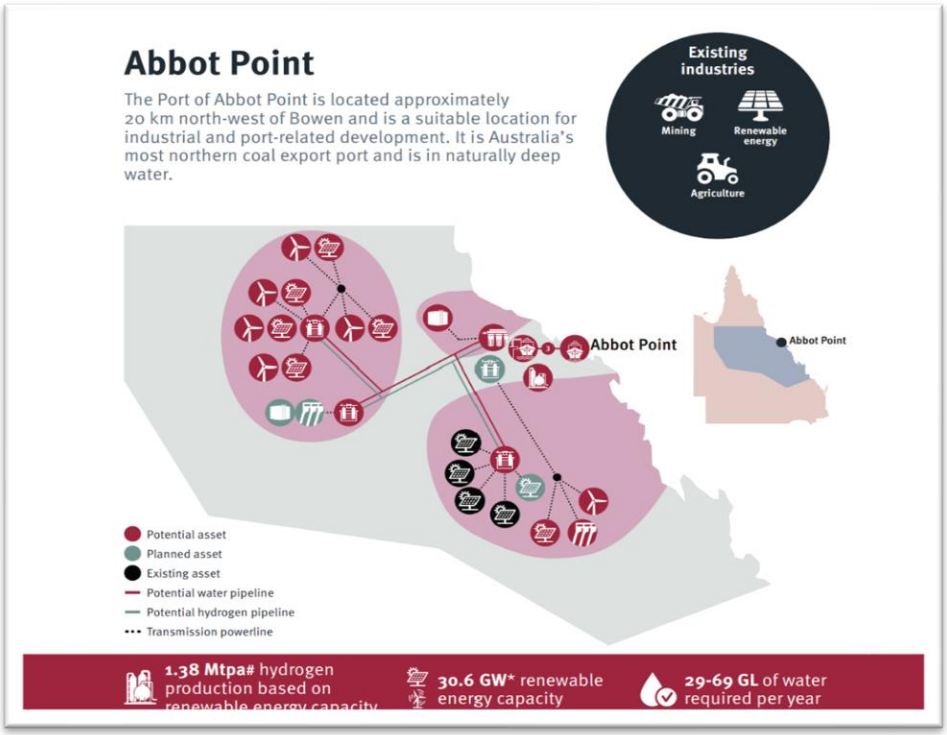
all by 2029, in line with the Copperstring timing (and the timing of first deliveries of ammonia products for export from the Port of Abbot Point).

Figure 1 – Double Circuit Line from Strathmore to Abbot Point

Candidate Hydrogen Port - Abbot Point

The Queensland Government has identified the Port of Abbot Point as a strategic port for exporting green hydrogen and derivative products.[3]

[3] https://www.epw.qld.gov.au/__data/assets/pdf_file/0017/33191/enabling-qld-hydrogen-opportunities-report.pdf)



The Queensland Government is currently allocating land to several proponents of large-scale green hydrogen projects at Abbot Point, of which HyNQ is just one, and enabling the development of a hydrogen industry through the Abbot Point Activation Initiative (APAI).

Recent and ongoing studies undertaken by the APAI include an opportunities analysis of large-scale water supply by pipeline from the Burdekin River, common user port infrastructure and master planning of common user and services corridors within the State Development Area.

Colocation of several hydrogen export projects requires approximately 6-10GW of renewable energy to be developed in North Queensland. Sufficient transfer capacity must be constructed alongside common infrastructure being master planned on Queensland Government land.

Japanese, Korean, European, and Singaporean governments are actively seeking production supply of hydrogen/ammonia by late 2020s. The Federal Government has announced its desire to support large-scale hydrogen exports.

EE believes the Port of Abbot Point is a key location for hydrogen production and conversion to ammonia – being a low-cost vehicle for energy storage and transportation - for export at scale.
This nationally strategic load is significant and needs to form part of the ISP planning for the shorter term to unlock the Abbot Point region.

Kickstarting the Hydrogen Industry

The HyNQ project engaged Baringa to conduct an independent high-level assessment of the business case for a large-scale green hydrogen and ammonia development at Abbot Point and included an overview of the global hydrogen market, focusing on APAC demand centres, and a commercial assessment of HyNQ's competitiveness as a large-scale green ammonia exporter.

The report found Abbot Point is in a strong competitive position within Queensland due to its strong renewable resources in proximity to renewable energy zones allowing for low cost behind the meter generation, along with access to grid infrastructure for green firming requirements, and the ability to deliver local grid benefits through flexible operation.

Large scale hydrogen export development at Abbot Point has competitive advantages in comparison to other large scale hydrogen export developments around Australia, adding value to the local economy through its shared infrastructure approach, while capitalising on existing export infrastructure.

Commercial assessment of the HyNQ project

HyNQ location at Abbot Point has access to very low-cost renewable generation and an existing deep-water port giving distinct advantages in cost-competitive export. HyNQ's shared infrastructure approach aligns with government policy in enabling a local green industrial hub in the region.

HyNQ's location at Abbot Point has a strong competitive position for renewable energy supply within Queensland

- **Low-cost renewable energy generation:** HyNQ is located close to both the Isaac and Northern Queensland Renewable Energy Zones (QREZ), with some of the lowest solar levelised cost of electricity (LCOE) and low wind LCOEs in Australia. Hence, HyNQ behind the meter generation will result in low-cost green hydrogen. The expansion of grid renewable energy projects in local QREZs will also allow for green and low-cost network electricity for firming which improves overall economics and ensures HyNQ is competitive. *[p. 43-45]*
- **Grid benefits to North Queensland constraints:** By combining the electrolyser with behind-the-meter renewable energy supply, HyNQ can operate in a flexible and cost-efficient manner with limited reliance on potentially costly grid supply. HyNQ's flexible operational profile and hybrid asset mix allows it to act as both a load and generator, strengthening the grid and meeting demand over peak periods. *[p. 47-53]*
- **Grid infrastructure at Abbot Point:** Infrastructure upgrades from the Queensland Energy and Jobs Plan (QEJP) and CopperString 2.0 will increase grid capacity and system strength in the Townsville/Abbot Point area. The HyNQ's planned connection location is likely to see benefits from these upgrades via improved ability to export its wind and solar generation to the grid *[p. 53]*

HyNQ has a unique competitive differentiation from other large scale hydrogen export projects in Queensland

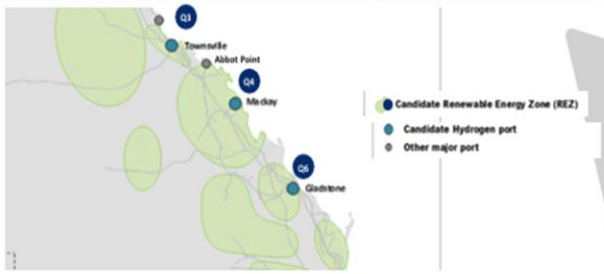
- **Alignment with Federal and State policy ambition:** The project is well aligned to achieve federal and state policy ambitions, particularly the Federal Government's Regional Hydrogen Hubs policy and the QEJP. Transitioning Abbot Point into a green energy hub will help to achieve government objectives, delivering long term benefits to North Queensland and broader Australia. *[p. 57-65]*
- **Build out of new industrial cluster based off local green hydrogen supply:** HyNQ will stimulate the growth of the hydrogen economy in the region by creating a new 'green' industrial hub, while providing hydrogen feedstock to support the decarbonisation of complementary industries. *[p. 67-70]*
- **Shared infrastructure approach:** Unlike other hydrogen export projects in development across Australia, the HyNQ project is pursuing a shared infrastructure model. This approach is based off lessons learned from the LNG sector and better aligns with government policy in creating regional hydrogen hubs, creating cost efficiencies while reducing environmental and cultural impacts. *[p. 71-74]*
- **Existing export infrastructure at Abbot Point can be repurposed for large-scale hydrogen export capabilities:** The deep-water port of Abbot Point is suited to large scale shipping. Currently the port is dedicated solely to exporting coal but has been identified for potential expansion to accommodate emerging trades . *[p. 76]*

Baringa

Renewable energy costs for solar and wind in QLD

The Townsville/Abbott Point region has highly competitive onshore wind and solar LCOEs relative to the rest of QLD. This is driven by high capacity factors, lower region-specific costs, and expected improvements to marginal loss factors in the area.

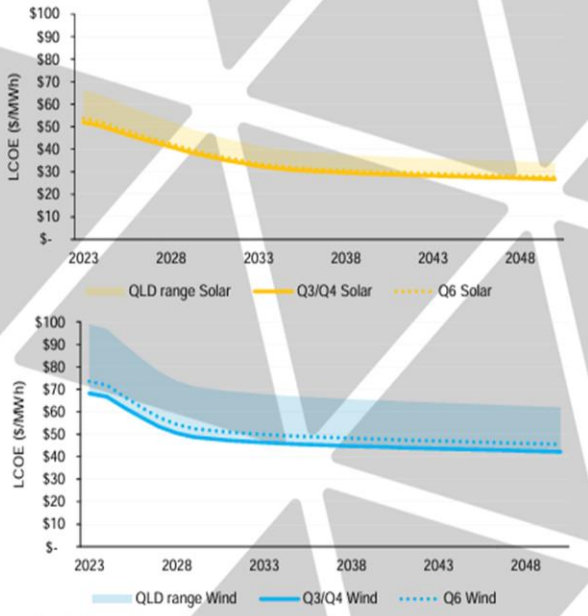
What drives lower renewable costs in the H_2 export focused QLD REZs?



Source: AEMO Draft IASR (2023)
Note: AEMO lists Townsville as the candidate hydrogen port in Q3 based on ARUP's 2019 assessment. The more recent National Hydrogen Infrastructure Assessment report notes space and other constraints which could limit its viability for large scale export vs other nearby ports (i.e. Abbot Point).

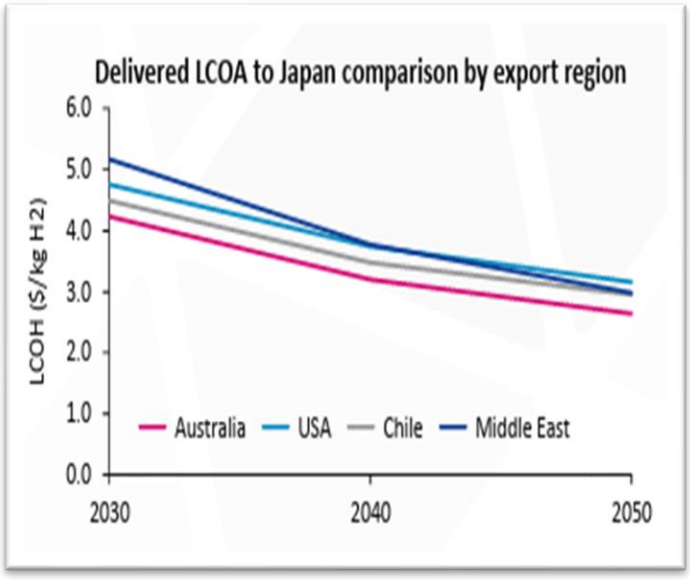
Driver	Commentary
Capacity Factors	• The region around Townsville and Abbott Point has some of the highest capacity factors for solar and wind in QLDat around 28-29% and 34-36% respectively. • As a result, LCOEs for Q3, Q4, and Q6 are among the lowest in the state.
Marginal Loss Factors	• While the North-Central regions in QLD have had historically low MLFs, announced transmission grid upgrades will substantially improve this by ~2029, particularly for Q3/Q4. • MLFs are similar for Q3, Q4 and Q6. However, MLF is significantly improved where renewable assets are co-located with loads (i.e. H_2 production) as opposed to contracting with off-site projects. This impact has been captured for the Q3/Q4 LCOEs in the figures to the right.
Regional Cost Adjustments (CAPEX, OPEX, grid connection costs)	• AEMO classifies the cost zones of each REZ to approximate expected regional differences which affect CAPEX, OPEX and grid connection costs. • All H_2 exporting regions are classed as 'Low Cost', which drives improvements over other REZs in QLD.

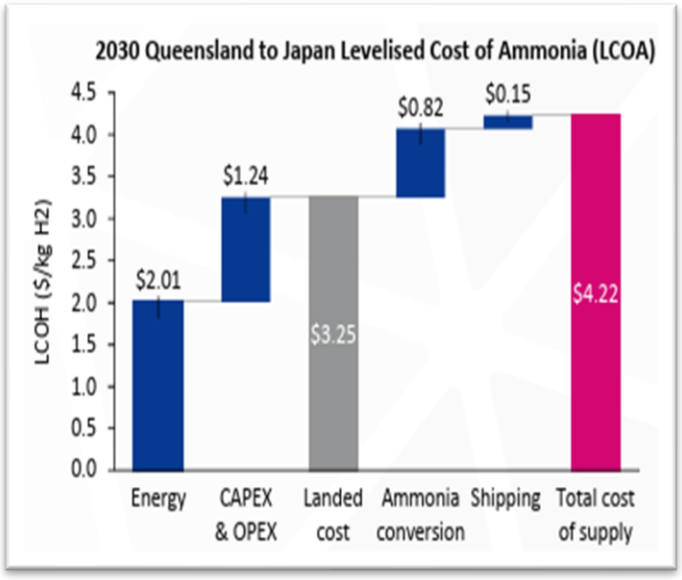
LCOE comparison: H_2 export zones vs range of QLD zones



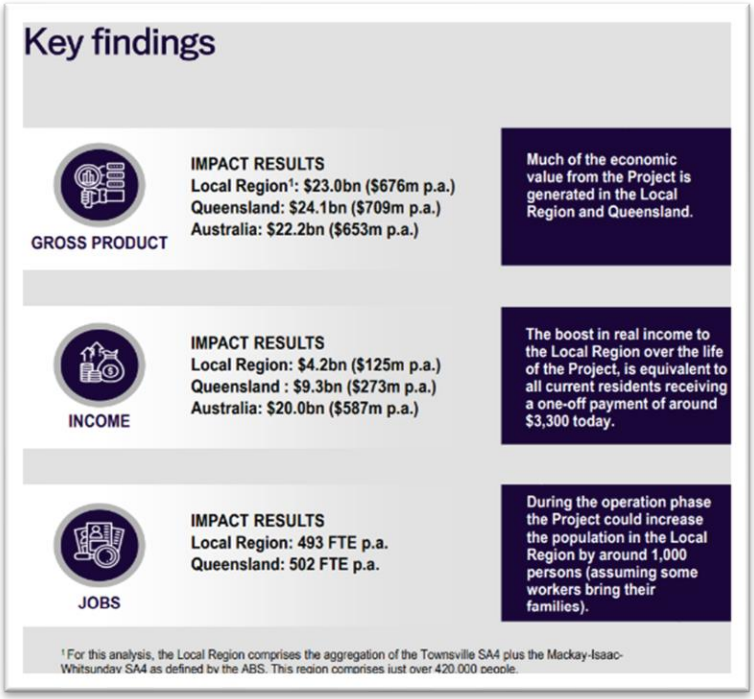
Source: Baringa analysis
Notes:
- *See Appendix B for LCOE calculation assumptions*
- *Q3 and Q4 have been grouped given the HyNQ project is located between the two zones. The characteristics of each are relatively similar, but with the area near Townsville/Abbot Point expected to see benefits from both CopperString and other grid augmentations planned.*

Baringa





The HyNQ project engaged Acil Allen Consulting to understand the economic impact the development of HyNQ will provide to the local and national economy. The following key findings table highlights the direct and indirect economic impact of the development on the economies of the local region and Queensland over the life of the project.



Both independent reports demonstrate the commercial and economic benefits of hydrogen development in Queensland. Nevertheless, unlocking the full opportunity for Queensland to become an energy superpower can only be attained with the requisite supporting grid infrastructure.

Background to our recommendation

Capability of the 275kV North-South network corridor

For Abbot Point to be developed to a 5-6GW supply requirement, to accommodate for several export projects, it will be necessary to connect it to the proposed 500kV Super Grid, as the 275kV augmentation

from Strathmore to Abbot Point can only export or import 1600MW if Strathmore's main north-south network corridor is not constrained during such a large power transfer.

HyNQ cannot rely on the existing grid to supply its hydrogen and ammonia plants fully. It is intended to deliver them primarily from local renewable energy sources, and the primary grid connection established by a new line from Strathmore will amply meet this project's residual power requirement.

In September 2022, the Queensland government released the Queensland SuperGrid Infrastructure Blueprint as part of the Queensland Energy and Jobs Plan (QEJB). The Blueprint is designed to implement foundational infrastructure to decarbonize Queensland's electricity system and load. It acknowledges significant new loads are likely to eventuate, impacting the optimal infrastructure pathway.

The first stage of Copperstring 2032 should be the Hughenden – Townsville 500kV double circuit, which is to be targeted for 2028, given more than one GW scale wind generation project is under development in the Flinders REZ. Major wind generators will have an important ongoing role in renewable energy supply to industry. These renewable generators should be connected to a grid that delivers their output to green industries developing at the ports of Northern Queensland as envisaged by the SuperGrid Blueprint. This must include Abbot Point as well as Townsville.

Reinforcement of the 275kV from Bouldercombe to Nebo to Townsville – as a double circuit high-capacity twin conductor transmission line - at an early stage, enables the 275kV grid to fully back up the loss of the 500kv circuit further enabling North Queensland to supply power to Gladstone as well as to the northern ports.

Early progression of the northern sectors of the SuperGrid backbone for completion in 2028 - with the development of a 500kV double circuit line from Hughenden to the 500kV hub south of Townsville and on to Strathmore - further unlocks renewable energy resources for large-scale, multi-proponent hydrogen development at Abbot Point, as well as offering increased grid stability, as referenced by Advisian in the Queensland SuperGrid Infrastructure Blueprint (September 2022).

Conclusion

Planning for a material spur-line from the existing Strathmore substation directly to the Port of Abbot Point as part of the 2024 ISP unlocks the commercial and economic benefits to the region and kickstarts Queensland energy superpower aspirations.

We recommend that the 2024 ISP include planning for a material spur-line from the existing Strathmore substation on the current 275kV network in North Queensland (proximate to Collinsville and the center of the proposed Collinsville REZ) directly to the Port of Abbot Point. That may:

- *initially, be a high capacity dual-circuit 275kV line; or*
- *should be planned as a 500kV line, connecting either into the eastern end of Copperstring (itself likely to be 500kV) or into an accelerated partial build-out of the Queensland SuperGrid North 500kV backbone from to Strathmore Substation,*

all by 2029, in line with the Copperstring timing (and the timing of first deliveries of ammonia products for export from the Port of Abbot Point).

We are grateful for this opportunity to provide feedback and welcome ongoing discussion with AEMO on the recommendation raised above.

Kind regards,

Mark Richards

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