

MEI Seminar Series

Seminar #4: The role of natural gas pipelines in the evolving energy system

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THE UNIVERSITY OF
MELBOURNE

Melbourne
Energy
Institute

Speaker:

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Dept of Mechanical Engineering
The University of Melbourne

MEI Seminar Series 2025



Seminar topic	Month
1. Conventional and unconventional natural gas	March
2. Gas markets and gas retailing	May
3. Liquefied natural gas (LNG) and export	June
● 4. The role of natural gas pipelines in the evolving energy system	July
5. Green hydrogen as an alternative to natural gas	August
6. Blue hydrogen as an alternative to natural gas	September
7. Options for hydrogen export	tbc

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Professor Richard Sandberg



Interim Director, Melbourne Energy Institute

**Chair of Computational Mechanics,
Mechanical Engineering**



Professor Richard Sandberg



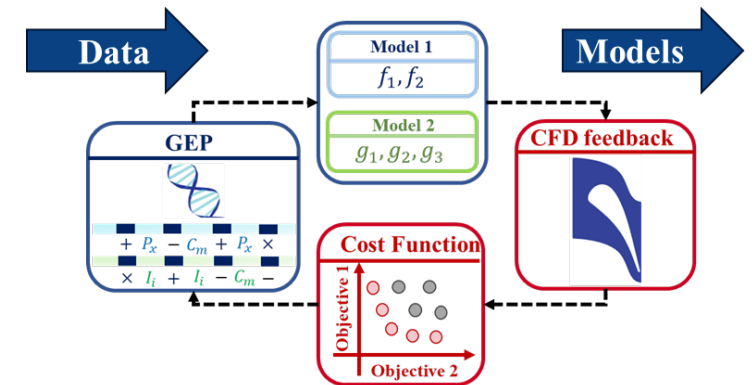
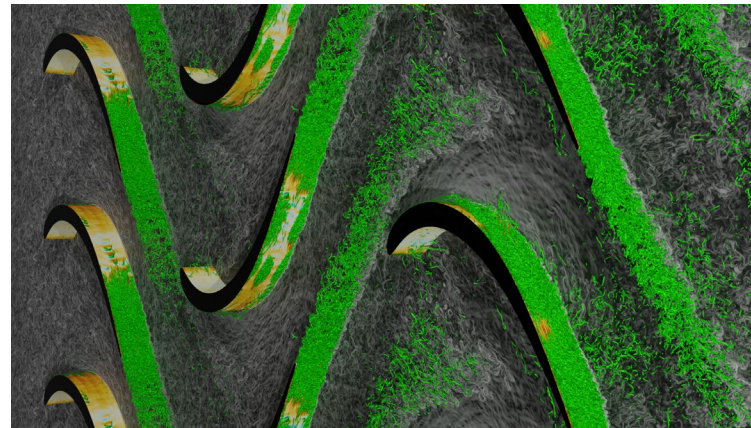
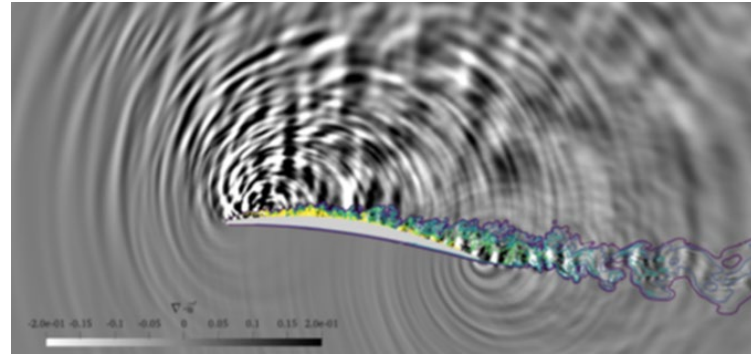
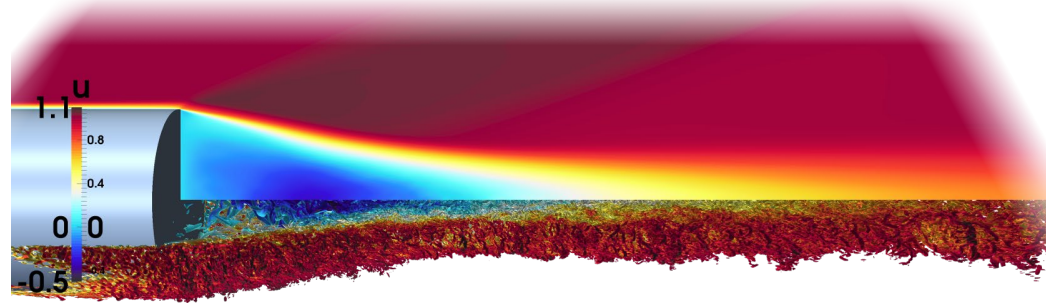
- 2004: PhD in Aerospace Eng.



- 10 years as an academic at



- Since 2015:
Professor in Department of
Mechanical Engineering



Agenda

01 Pipeline Network

02 Demand

03 Supply

04 Closing thoughts

01

Pipeline Network



Pipeline Network

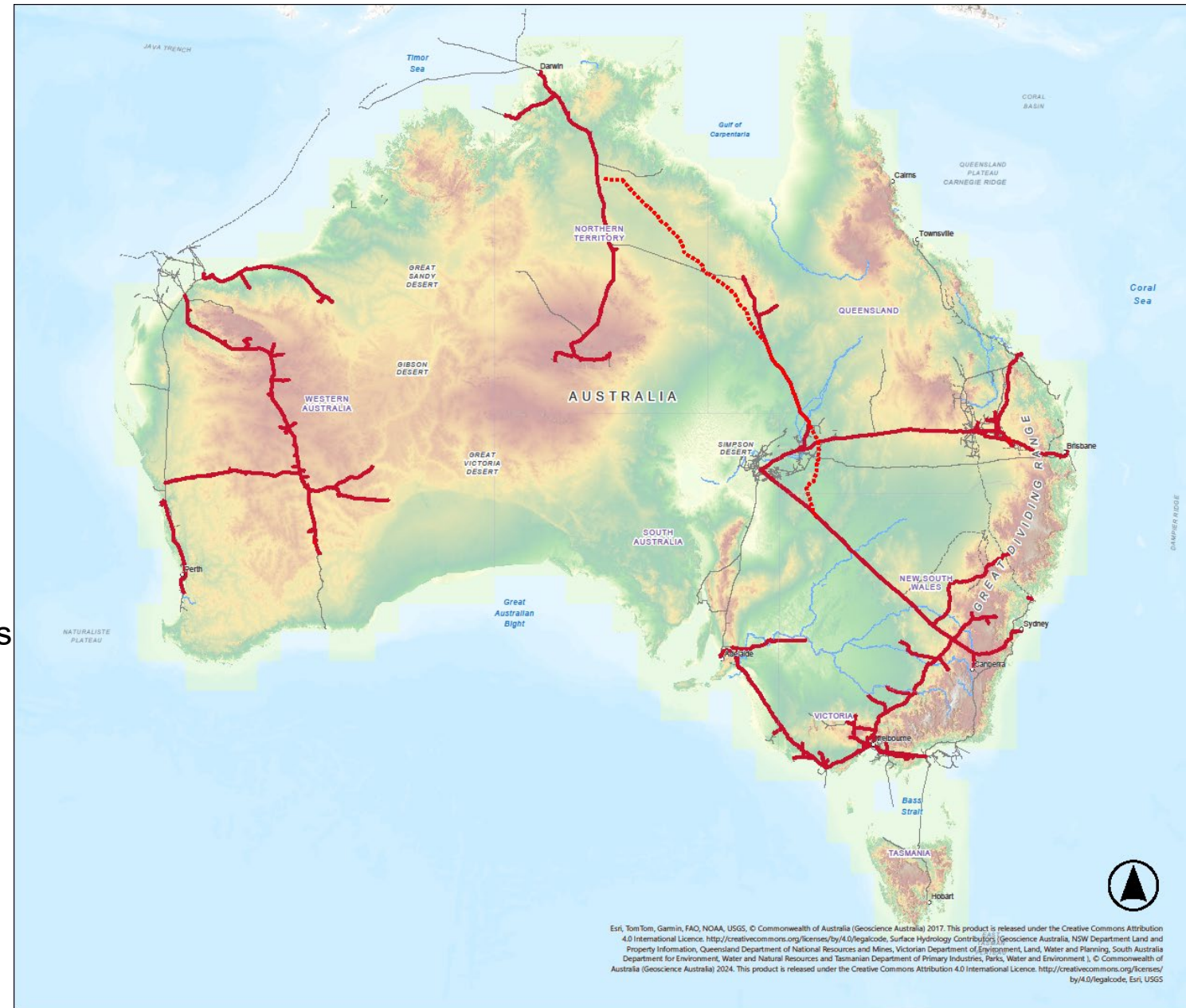
Prior to 2000, Australia pipeline network was series of point-to-point pipelines with limited gas storage options.

Today, the network has numerous bi-directional flow pipeline, regional interconnector and gas storage options.

Demand swings on pipeline and production facility are managed using storage. Three types of gas storage are utilised in Australia, namely dedicated pipelines, LNG tanks or underground.

To efficiently match supply with demand shippers have a range of trading options. These include long-term supply agreements, in-pipe trades or access to various trading hubs.

Peak demands periods differ across the network. WA and Northern demands are high in summertime/wet season whereas NSW/Victoria demand is high in Winter.



Pipeline Network

East Coast Gas Grid

Figure 4 is lifted from AEMO's GSOO 2025 and simplified for this presentation to show gas adequacy for the next 5 years **before storage**. mDomestic consumption is shown in the base with gas consumed for power generation in yellow on top.

In 2028 and 2029, the forecast shows that the production needs

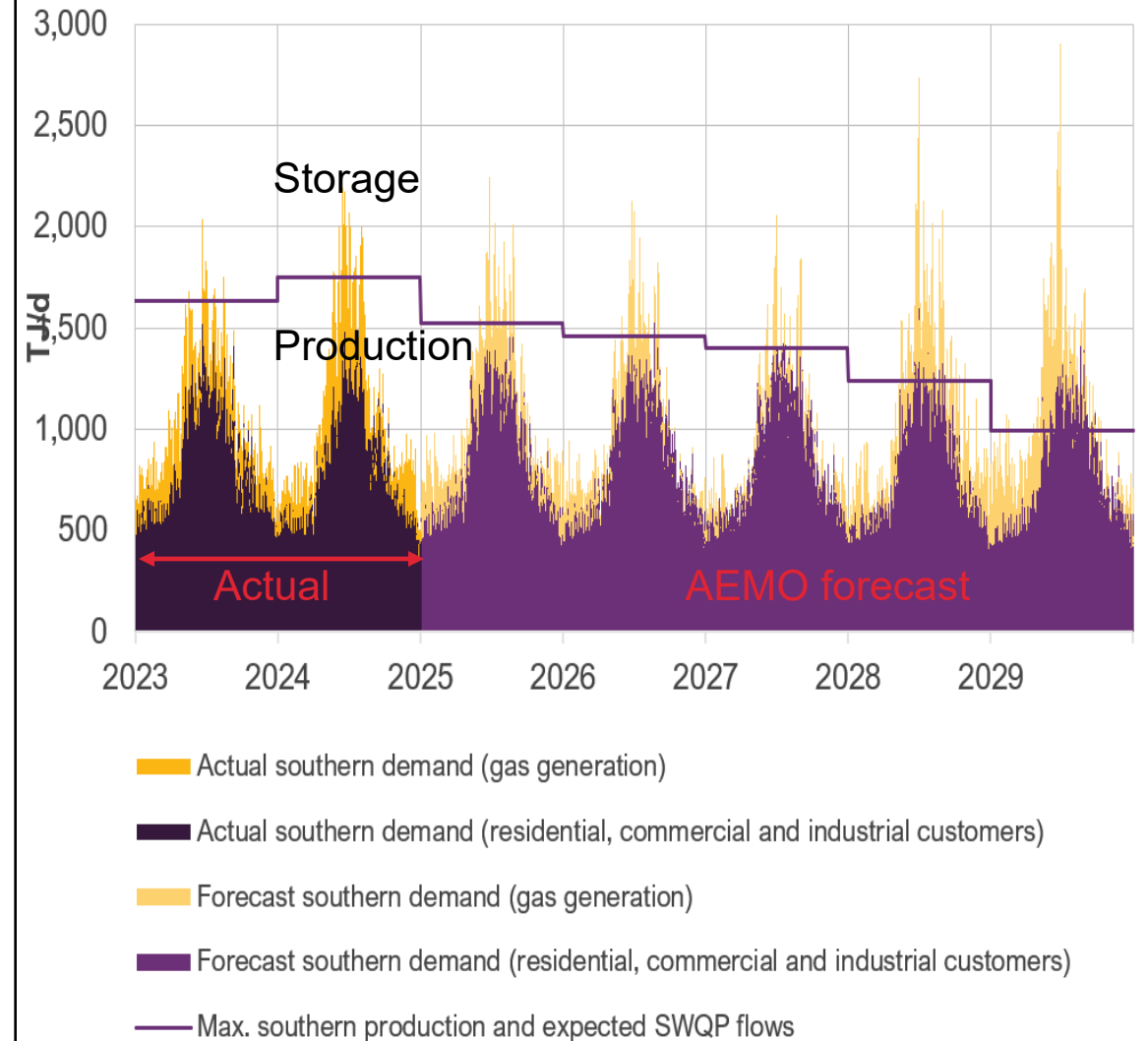
- additional renewable and/or
- traditional gas supplies and/or more gas storage for peak days

Fun Facts

1:10:100 Rule of thumb

1GW of GPG running 10hrs consumes 100TJ

Figure 4 - Actual daily southern gas system adequacy since January 2023, and forecast to 2029 using existing, committed and anticipated projects (TJ/d)



02

Demand

Gas Demand

Let's look ahead

1. NEM Energy demand for Gas and Electricity
2. Gas-Firming GPG operating profiles
3. Pathway to utilising the pipeline to minimise incremental capex

Observation:

AEMO's forecasts are still evolving around the impact and timing of data centre & AI load growth on required energy

Gas Statement of Opportunity (**GSOO**)

Integrated System Plan (**ISP**)

Gas production can be a very long way from demand centres



Energy Demand

GPG planning horizon +5years

AEMO GSOO 2025 and ISP 2024 key takeaways for the pipeline system are

- Figure 1 from GSOO domestic gas demand will **fall**
- Figure 2 from GSOO GPG annual gas consumption will **fall**, but peak day demand will **increase**
- Figure 1 from ISP coal closures announcements
 - 1/4 of today's fleet will be closed
 - **misaligned** with Australian emission targets

Figure 1 Coal capacity, NEM (GW, 2009-10 to 2049-50)

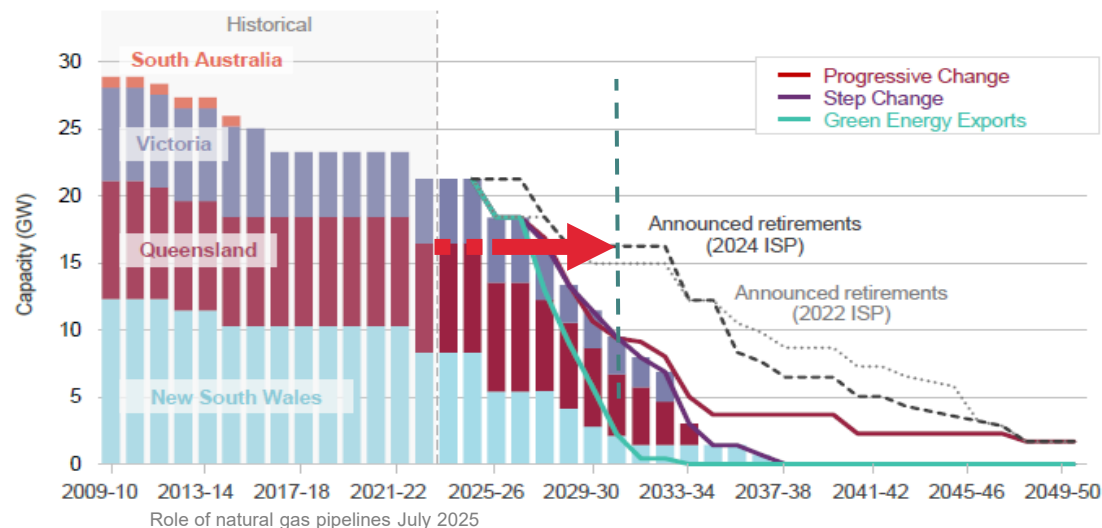
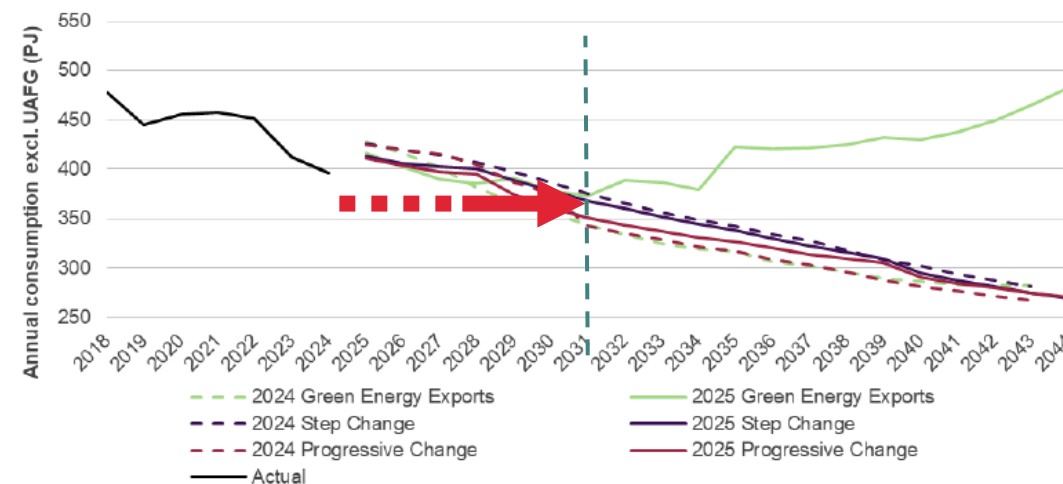
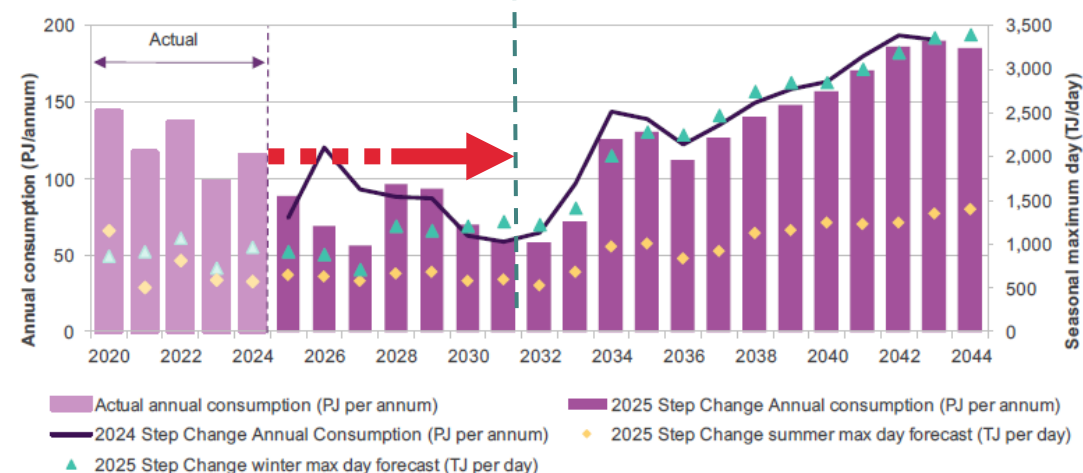


Figure 1 Actual and forecast domestic covered gas consumption, excluding GPG, all scenarios and compared to 2024 GSOO forecasts, 2018-44 (PJ)



Note: The Northern Territory is included in actual gas consumption from 2020 onwards.

Figure 2 Actual and forecast NEM and Northern Territory gas generation annual consumption (PJ/y) and seasonal maximum daily demand (TJ/d), Step Change scenario, 2020-44



Gas Demand

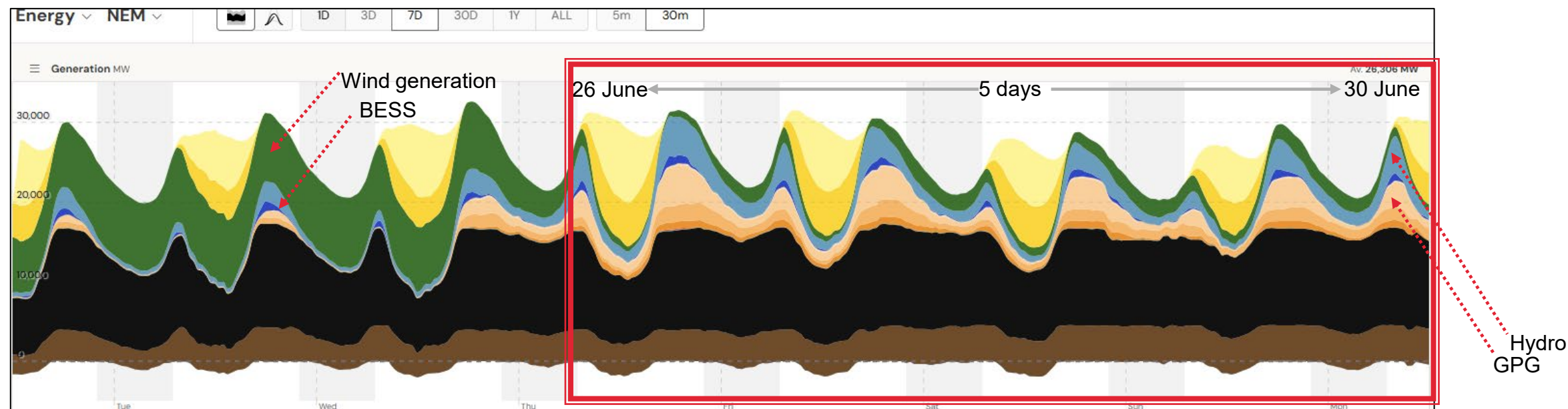
GPG demand growth to firm renewables as coal generation closes

AEMO predicts in *2024 Forecasting Assumption Update workbook* that coal generation closures will need +8GW of incremental GPG. +8GW of gas-firming GPG is a seriously large uplift in peak demands on the pipeline system.

Different operating strategy utilising a combination of

- gas storage and
- flow reversal of the prevailing flow direction of gas supplies will mitigate expansion capex

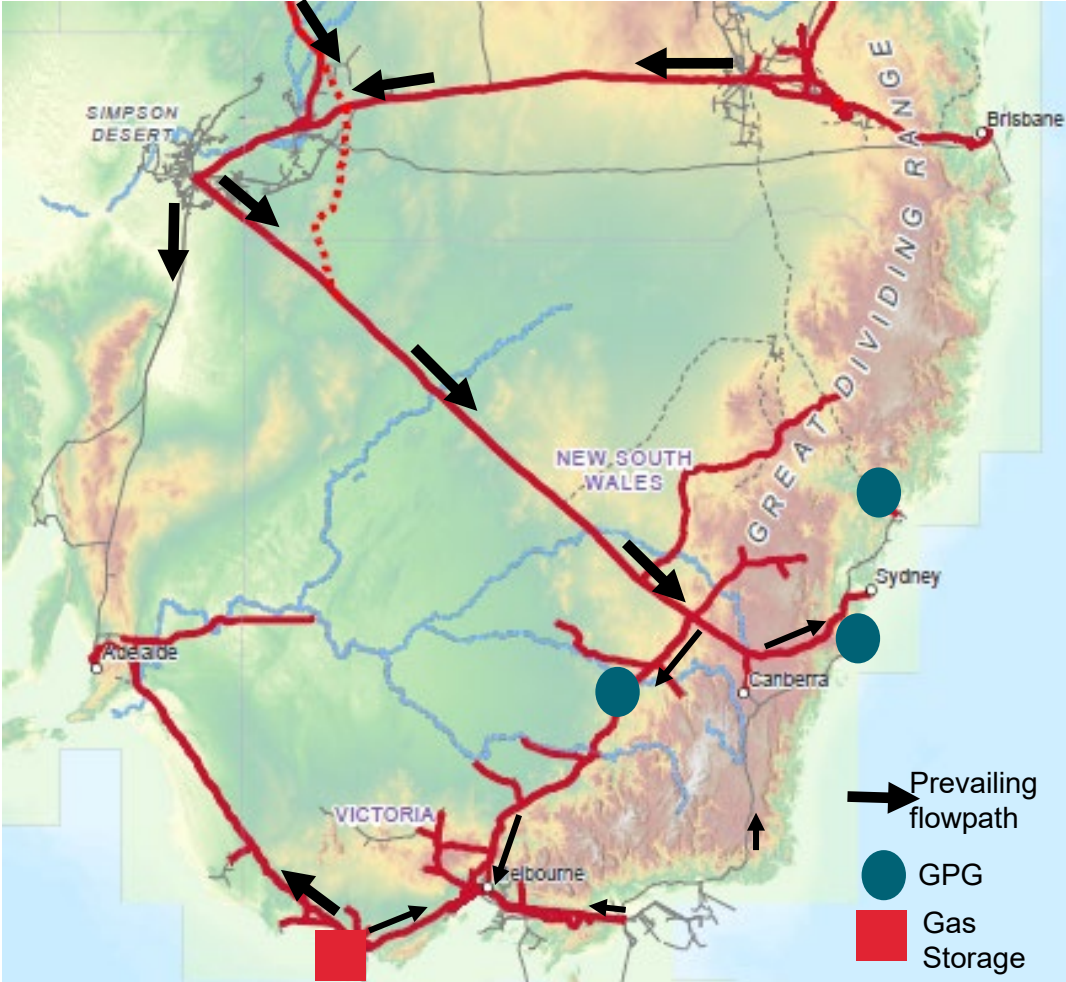
Below is a recent 5 day *dunkelflaute* event in the NEM. At the start of the snapshot, we have a period of renewable generation before transitioning into a period with PV plus high hydro support



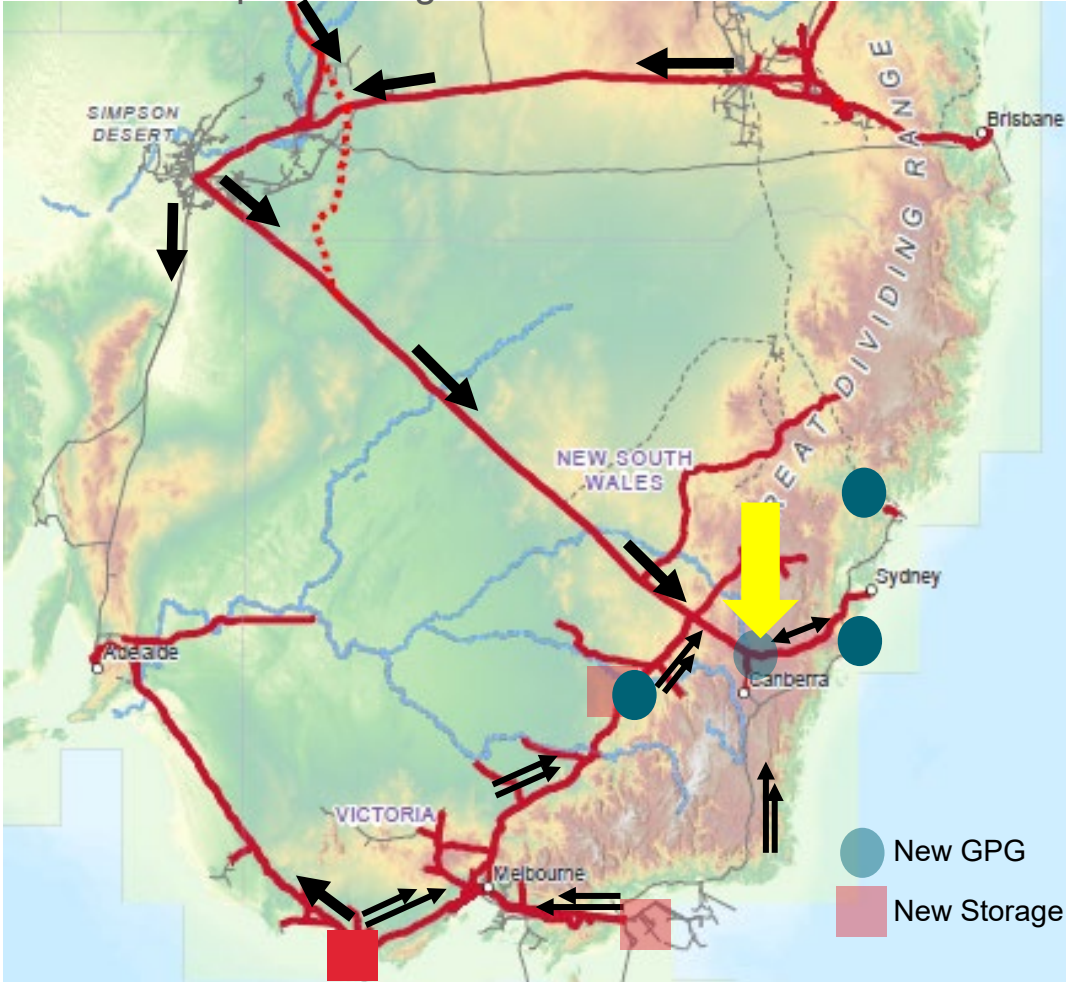
GPG Peak Gas Demand

New GPG in NSW

Domestic + low/Zero GPG demand



Dunkelflaute period - high GPG demand



03

Supply



Supply

1. Legacy gas production fields are in decline
2. Drilling campaigns are seeking to extend the useful life of these legacy production locations
3. Explore alternate gas producing locations be they natural gas or renewable gases
4. GSOO 2025 highlights pipeline network expansion with gas storage will meet all demand profiles **with domestic gas**
5. Importing LNG is technically viable, but it could lead to an increase cost of gas which then flow thru to power prices
6. Virtual "LNG Import" is a viable alternate to importing LNG cargos.

This solution involves purchasing LNG cargos at the wellhead in Qld and re-directing those volumes thru the pipeline network thereby avoiding liquefaction and shipping losses with handling LNG



Compression on the Northern Goldfield Interconnector (WA)

Pipeline expansions

Key insights (Section 5 of GSOO – Figure 51 and 54)

A range of proposed projects can provide sufficient supply to delay the forecast supply gaps to 2033 or 2034 and help to mitigate the risk of peak day shortfalls:

- **A combination of solutions, including new gas storage and additional northern supplies,** is required to address southern gas supply risks from 2034.
- **Increased storage** to cater for increasing seasonal peaks is necessary to support all developments. The network injection capacity, location and timing of new storages will depend on the volume of new gas supplies that can be sourced locally in, or transported to, southern demand centres.

Figure 51 Range of southern annual supply gaps for future supply options assessed, including additional storage build, 2025-44 (PJ)

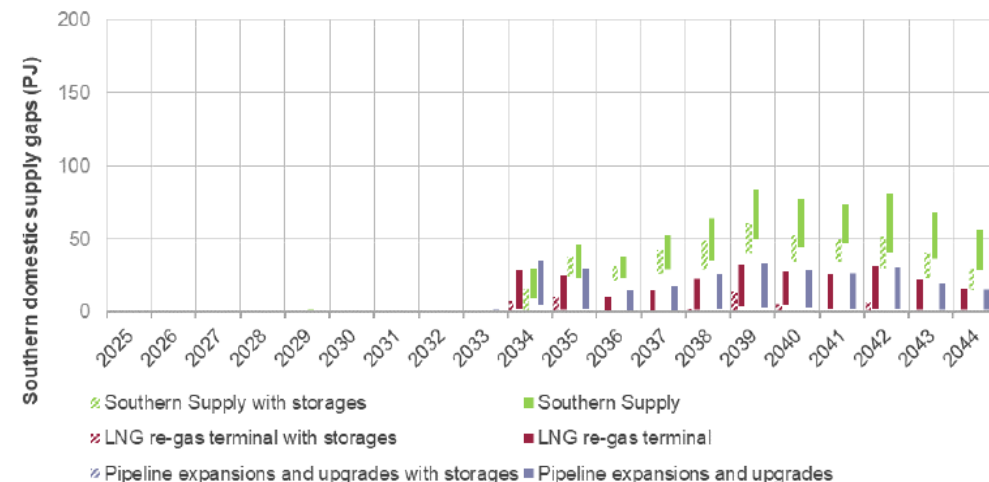
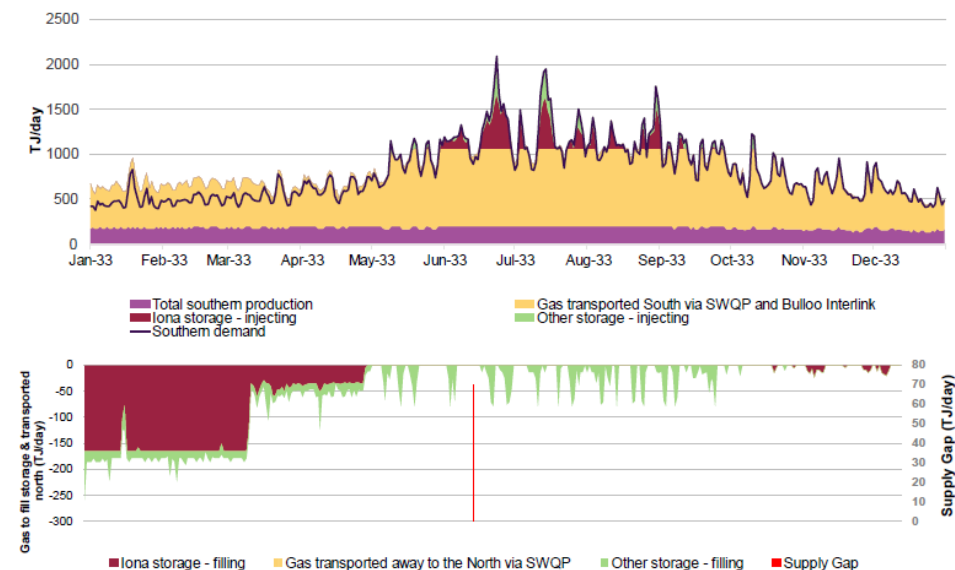
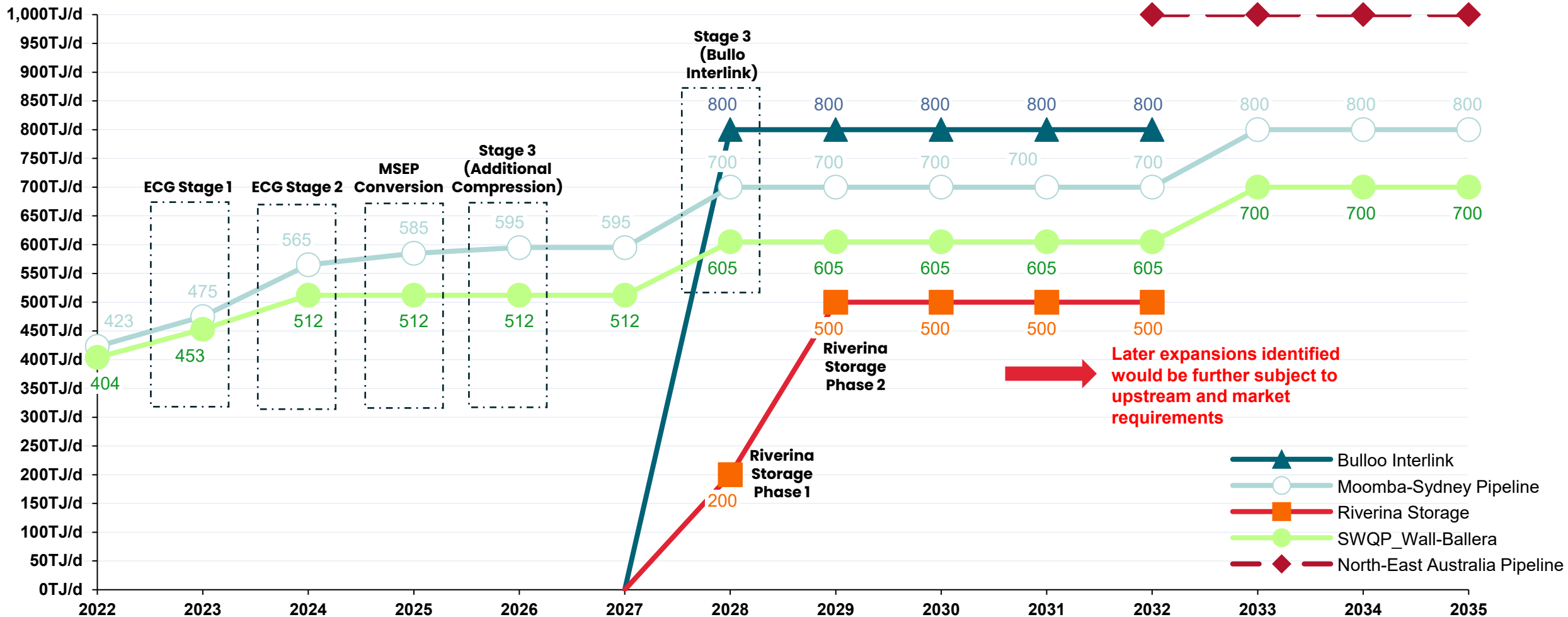


Figure 54 Supply-demand balance for the Pipeline Upgrades and Expansions option, 2033, Step Change (TJ/d)



ECGG Expansion Plan capacity progression

A clearer path for north-south gas flows has been identified to deliver domestic, lower priced and lower emissions gas to southern markets



03

Closing thoughts



APA's Climate Transition Plan 2.0 will be published in the next quarter. This is our first 3-yearly update. It contains lots of stats and a few insights from emission reduction projects.

Wallumbilla Hub in QLD has nine gas compressors. Three different approaches to reducing emission from the compression plant are under evaluation

- Procuring renewable methane to fuel the as-is compression plant
- Install new electric-drive compression. Required an electricity expansion of 13km
- Install new electric-drive compressor and power it with an off-grid renewable generation solution

Status

The economics of all approaches need more work

Many new products are coming to the markets which is allowing us to improve performance



Q & A



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