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# Decarbonising Energy for Pilbara Mines

## 8th Annual Energy and Mines Conference

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APA Pilbara electricity transmission – Newman to Roy Hill, Chichester and Cloudbreak

# Acknowledgement of Country

At APA, we acknowledge the Traditional Owners and Custodians of the lands on which we live and work throughout Australia.

We acknowledge their connections to land, sea and community.

We pay our respects to their Elders past and present, and commit to ensuring APA operates in a fair and ethical manner that respects First Nations peoples' rights and interests.

# What will be covered today:

1. The current energy landscape for Pilbara mines and opportunities for incorporating renewable energy
2. Key transmission developments to enable large-scale renewables for miners in the region
3. How are gas pipelines placed to support renewable energy and electrification for Pilbara mines?
4. What are the key challenges facing developers/operators

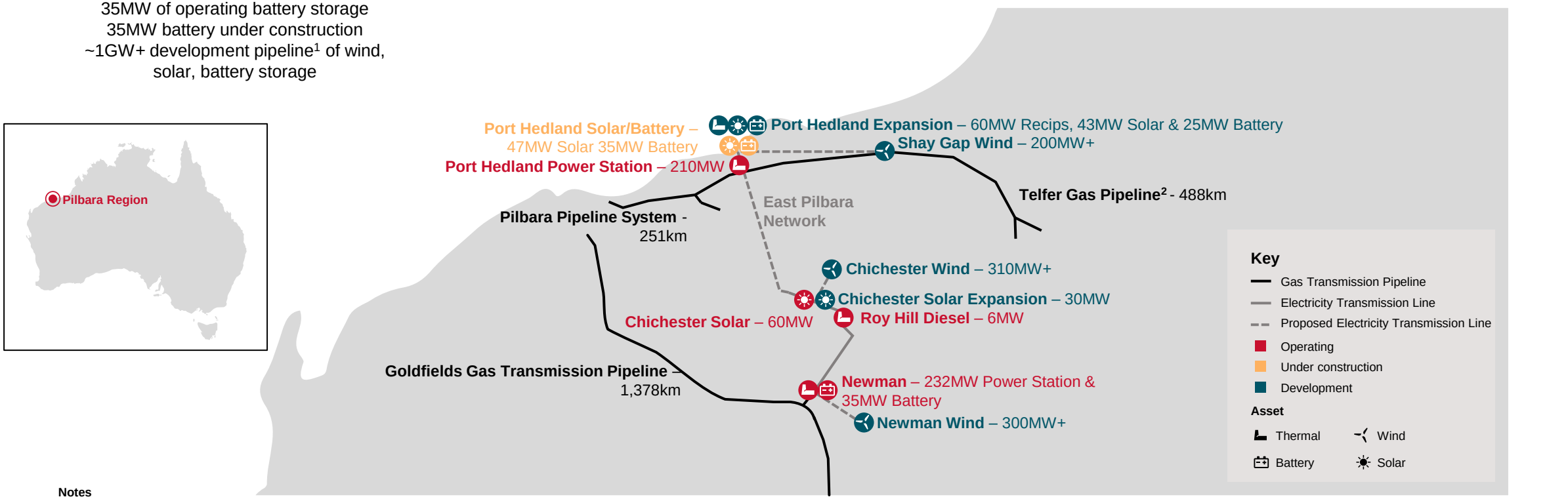
# APA's Pilbara diversified energy infrastructure portfolio

**Renewables / Storage**
60MW of operating solar
47MW solar under construction
35MW of operating battery storage
35MW battery under construction
~1GW+ development pipeline[1] of wind, solar, battery storage

**Thermal**
442MW of gas generation
75MW development pipeline[1]

**Electricity transmission**
>200km operating transmission
>600km development pipeline[1]

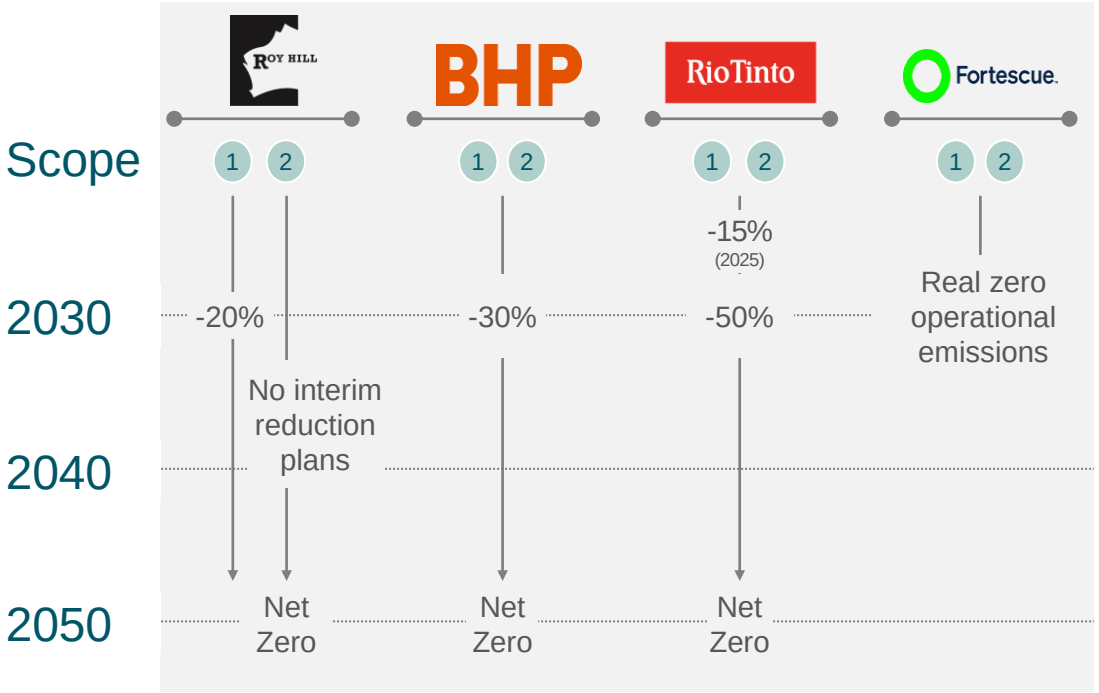
**Gas transmission**
Goldfields Gas Transmission Pipeline (GGT)
Pilbara Pipeline System (PPS)




**Notes**
1. Development pipeline capacities based on current project design, subject to change up until final investment decision
2. Asset owned by Energy Infrastructure Investments, of which APA Group holds a 19.9% stake

# The majors in the Pilbara have set targets

## Decarbonisation targets of major minors[1]




## Forecast shift to electrification for decarbonisation

| Iron Ore Mining Stage | Energy Demand[2] | 2023 Relative Pilbara Forecast Electricity Demand (% of total value chain)[8] | 2050 Relative Pilbara Forecast Electricity Demand (% of total value chain)[8] |
|---|---|---|---|
| Drill & Blast | Drill rigs and excavators | ~0% *(Currently, mainly diesel fuel)* | ~55% |
| Ore Mining & Transport to Crusher | Haul trucks | | |
| Ore Processing<br>Mine Train Load Out | Stationary mine operations | ~80% | ~30% |
| Rail Transport | Locomotives | ~0% *(Currently, mainly diesel fuel)* | ~10% |
| Ship Loading | Port operations | ~20% | ~5% |

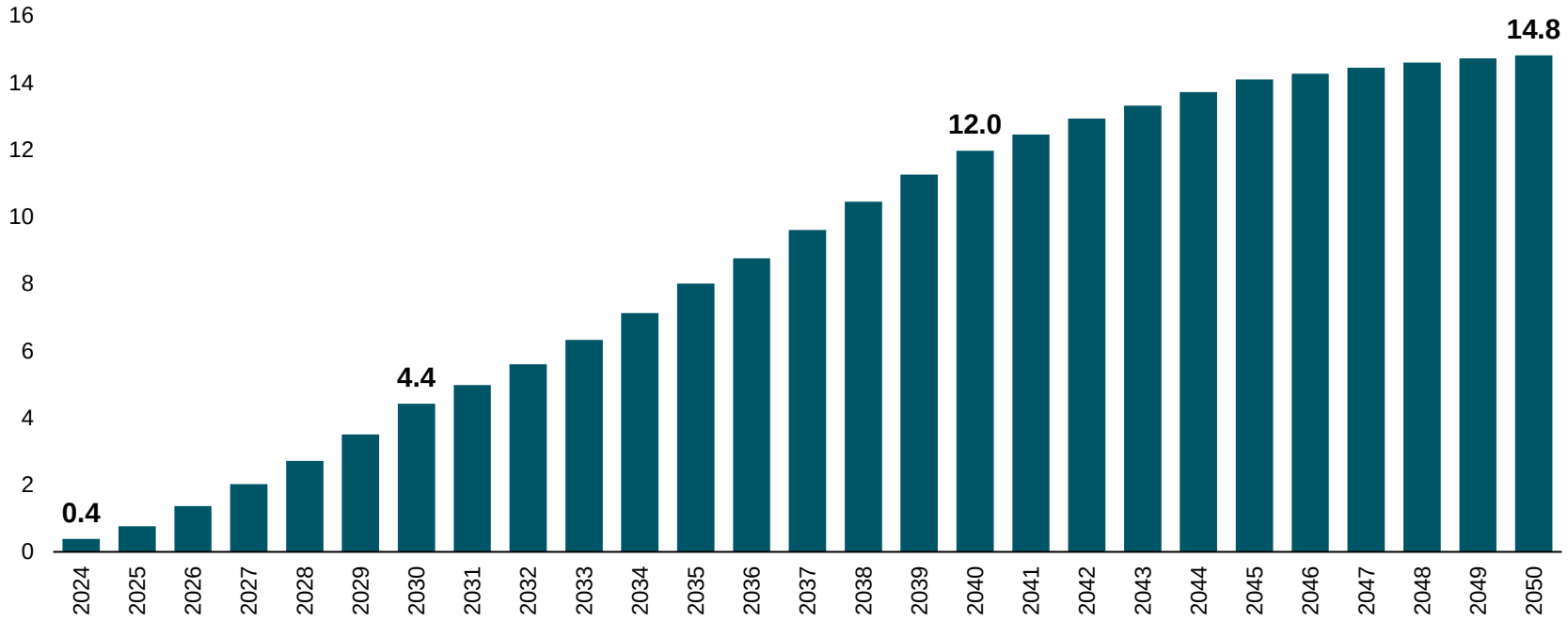
**Notes**

1. Adapted from page 17, Acquisition of Alinta Energy Pilbara and equity raising, 23 August 2023, APA Group, https://www.apa.com.au/globalassets/asx-releases/2023/fy23-results/apa_acquisition-and-equity-raising_presentation_23-aug23.pdf
2. BCG analysis - Forecast includes the NWIS (incl. Rio Tinto's Pilbara Iron network), FMG's Pilbara Energy Connect network, and BHP/Alinta's Newman network, and excludes isolated power stations servicing isolated mines and towns east of the NWIS, and isolated power stations servicing mines, towns and associated infrastructure to the west of the NWIS. Extent and timing of displacement will be subject to miner decarbonisation ambitions and technology evolution.

# Decarbonisation drives significant electricity demand growth

## Renewable energy generation expected to be required (TWh)[1]

**Renewables electricity generation in the Pilbara expected to increase by ~30x from 2024 to 2040**



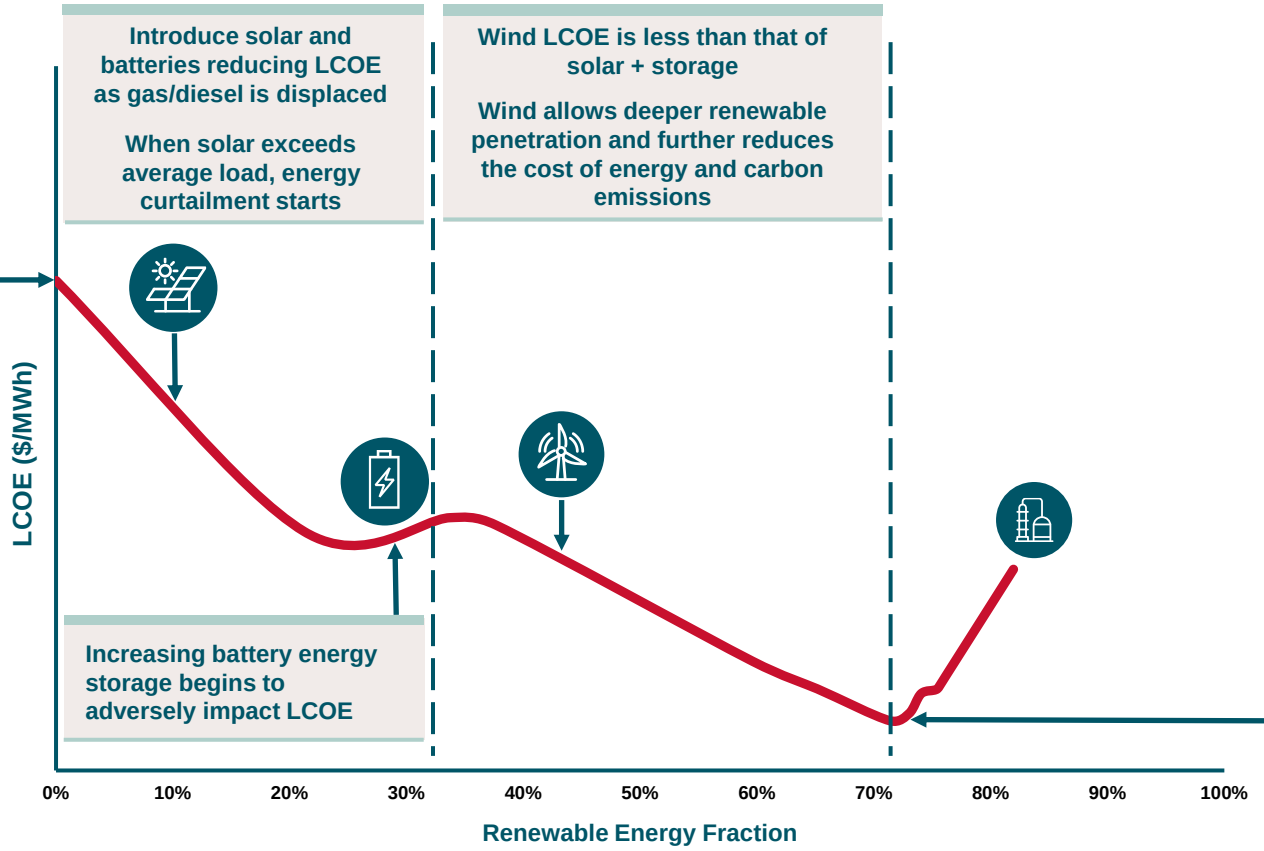

- Decarbonisation requires **new sources of renewable generation and interconnection** for the region (solar, wind, battery, transmission and green hydrogen)
- Miners will need to substantially start the transition to renewable sources **within the next decade** to meet net zero targets
- Future electricity demand is dominated by **decarbonisation of haul trucks, heavy machinery and locomotives**
- **Gas fired power generation to play ongoing role in providing firming and reserve capacity**

**Notes**

1. Adapted from Acquisition of Alinta Energy Pilbara and equity raising, 23 August 2023, APA Group, https://www.apa.com.au/globalassets/asx-releases/2023/fy23-results/apa_acquisition-and-equity-raising_presentation_23-aug23.pdf .

# The first step will always be solar

## Indicative Levelised Cost of Energy (LCOE) vs Renewable Energy Fraction




Remote facilities typically start with 100% thermal

The decarbonisation journey starts with a reliance on gas (diesel has significantly higher costs)

Introduce solar and batteries reducing LCOE as gas/diesel is displaced

When solar exceeds average load, energy curtailment starts

Increasing battery energy storage begins to adversely impact LCOE

Wind LCOE is less than that of solar + storage

Wind allows deeper renewable penetration and further reduces the cost of energy and carbon emissions

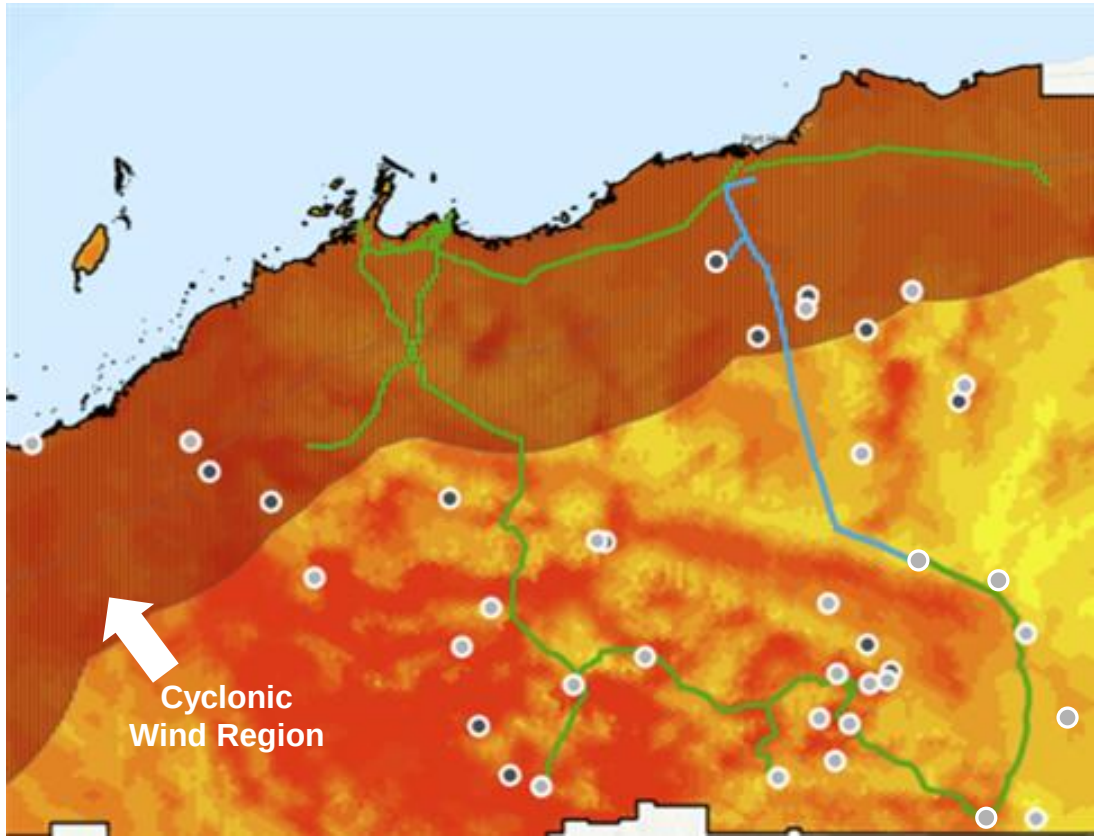
Emissions reductions beyond this point impacts LCOE

LCOE is optimised with firming power supply via gas firming when there are low levels of solar or wind generation.

The final carbon abatement differs with the starting point and its not always 1 for 1. For example

- Large combined cycle plants cannot respond fast enough to changes in renewables and have poor turn down and as such will generally always be on with relatively high emission rates forcing renewable curtailment
- Smaller open cycle units can react quickly with excellent part load efficiency(for reciprocating engines) minimising renewable curtailment allowing near 100% renewable outcomes to be realized in the medium term

# Mines are generally not proximate to the wind sites




<$80/MWh LCOE >$150/MWh

## Renewable Deployment

✓ **No centralised planning**
Existing lines were generally built by miners in isolation or to serve specific mines with fit for purpose infrastructure

✓ **Wind resource**
The good wind sites are north and east of the Chichester Ranges and Hammersley Ranges quite far from the most productive mines

✓ **Cyclonic region**
Wind turbines will not survive the Table D wind loadings along the Pilbara coast which extend 150km inland

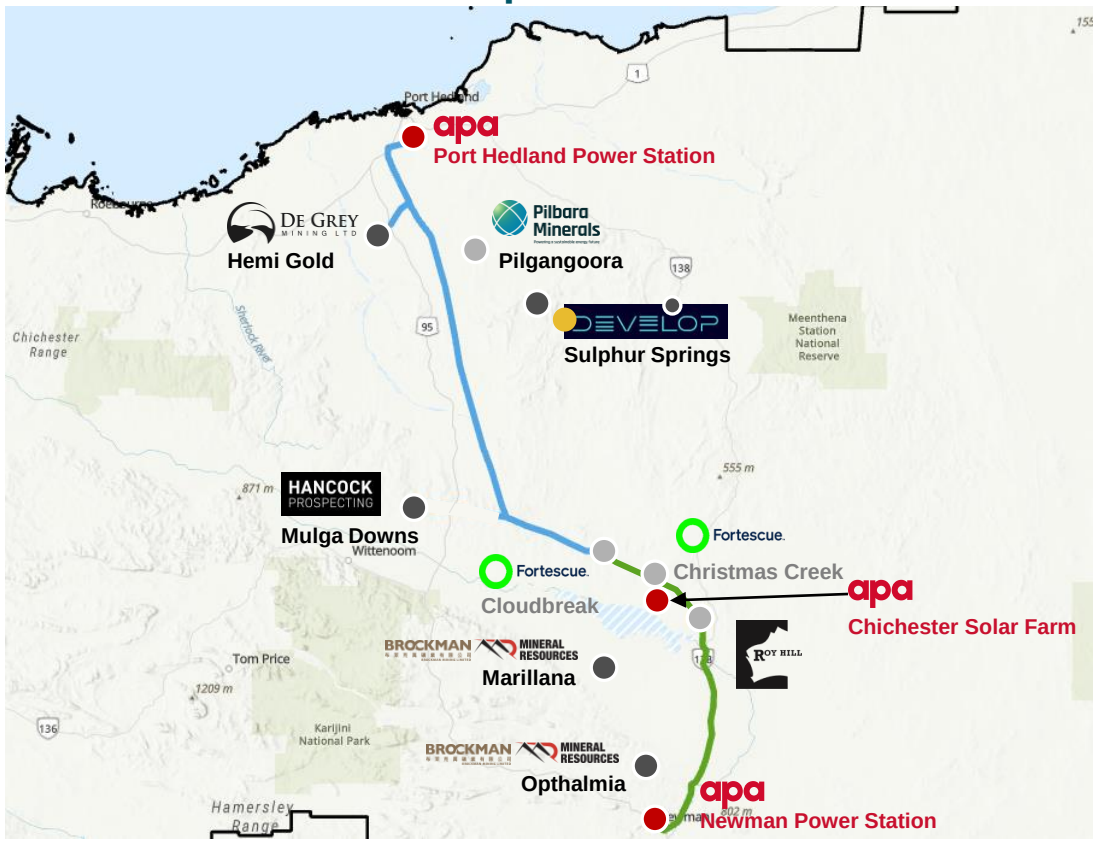
✓ **Opportunity to accelerate common-user infrastructure**
Where mines are close to existing transmission assets these can be leveraged to provide access to distributed gas and renewable generation to customers at lower cost

✓ **Security of supply**
Common-user infrastructure allows the network operator to aggregate ESS services to further lower costs

✓ **Pit to Port connection**
Completion of APA's East Pilbara Network will facilitate significant transfer of renewable generation from inland to the coast and facilitate optimisation of gas pipeline utilisation

# APA's East Pilbara Network Opportunity

## East Pilbara Network map[1,2]




**Legend**

- APA transmission line
- East Pilbara Network
- APA power station
- Existing mine
- Proposed mine

**Notes**

1. EPN indicative route as provided in MS333 and is subject to change based on final tenure agreements
2. Proposed mines and locations per the Resources and Energy Major Projects List, published by the Department of Industry, Science and Resources. Proposed mines are noted for illustrative purposes and do not represent contracted EPN customers

## Why East Pilbara Network (EPN)?

✓ **Customer lead**
Almost every previous attempt to complete this initiative fails because they have not focussed on the customers requiring power

✓ **APA understands the region and customers**
Long-term owner/operator with capability to manage customers and safely operate infrastructure

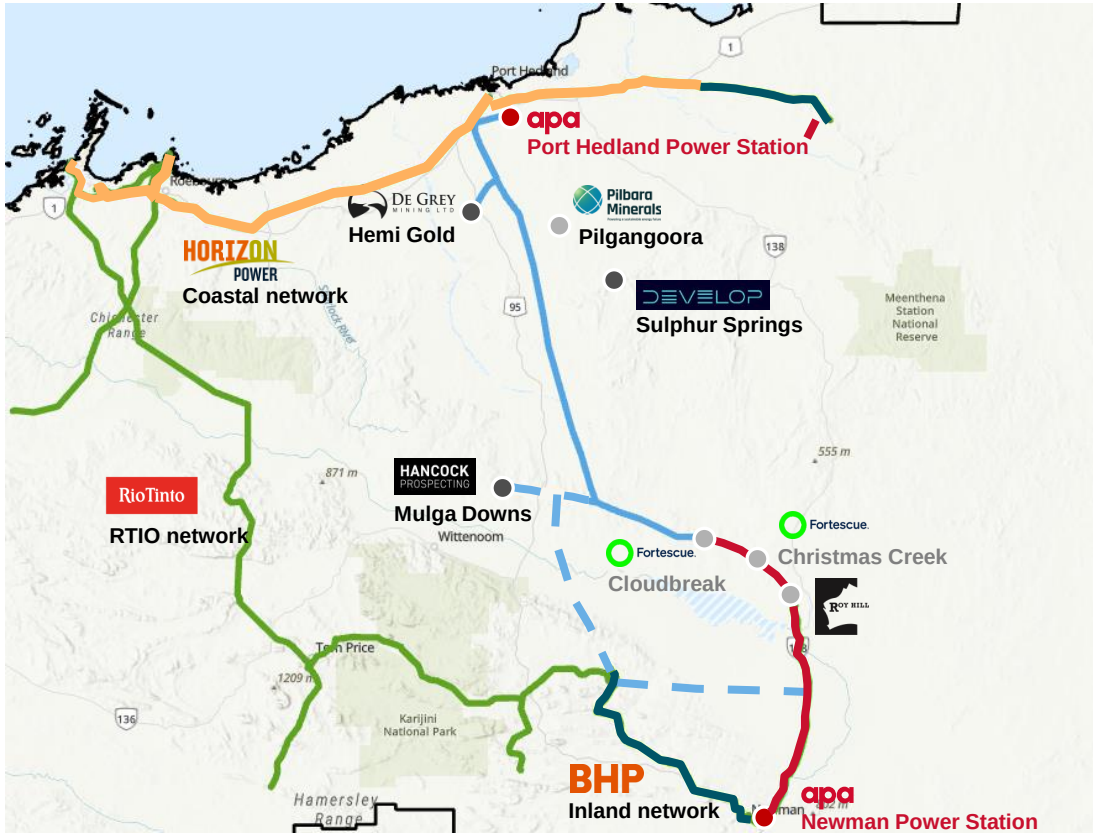
✓ **Project aligns with Government policy**
Supports NWIS evolution and common-user approach

✓ **Opportunity to accelerate common-user infrastructure**
APA is developing the first stage of the EPN and the section from Cloudbreak to Newman is complete

✓ **Supports decarbonisation of the Pilbara**
An upsized line enables connection of loads and facilitates new renewable energy generation

✓ **APA has strong Traditional Owner relationships**
Agreements already secured for the proposed corridor

# Near term key electricity transmission development opportunities




**Legend**

- APA transmission line
- East Pilbara Network
- APA power station
- Existing mine
- Proposed mine
- BHP electricity network
- Rio Tinto network
- Horizon network
- EPN potential interconnections

## The key building blocks are already there

✓ **APA is ready to go all in**
APA's Chichester networks are already open access and a legacy connection at BHP Yarnima power station exists

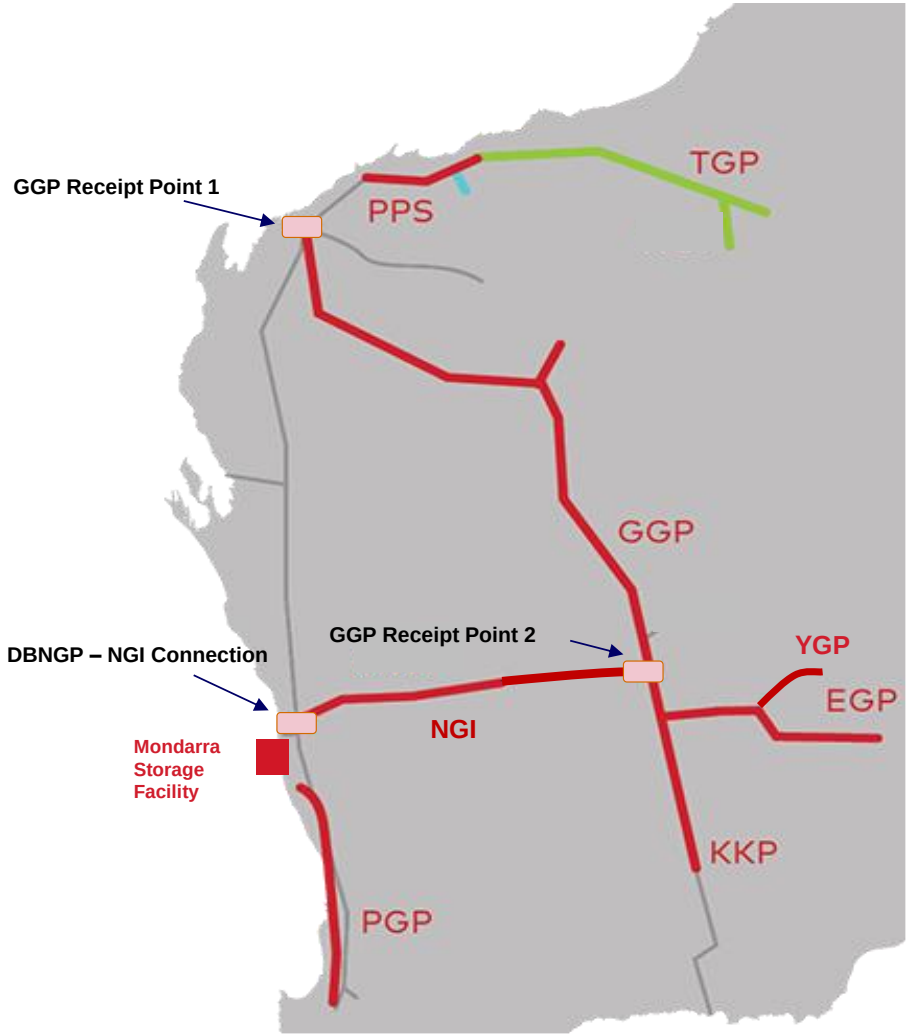
✓ **APA EPN**
Will be open access

✓ **The NWIS**
Extends all the way from Port Hedland to Hope Downs 4 via Cape Lambert and Karatha

✓ **Rio Tinto and BHP**
Interconnection between all networks is entirely feasible

✓ **Network Operation**
Likely requirement for the system operation to evolve

# How is Gas Positioned to Support the Energy Transition

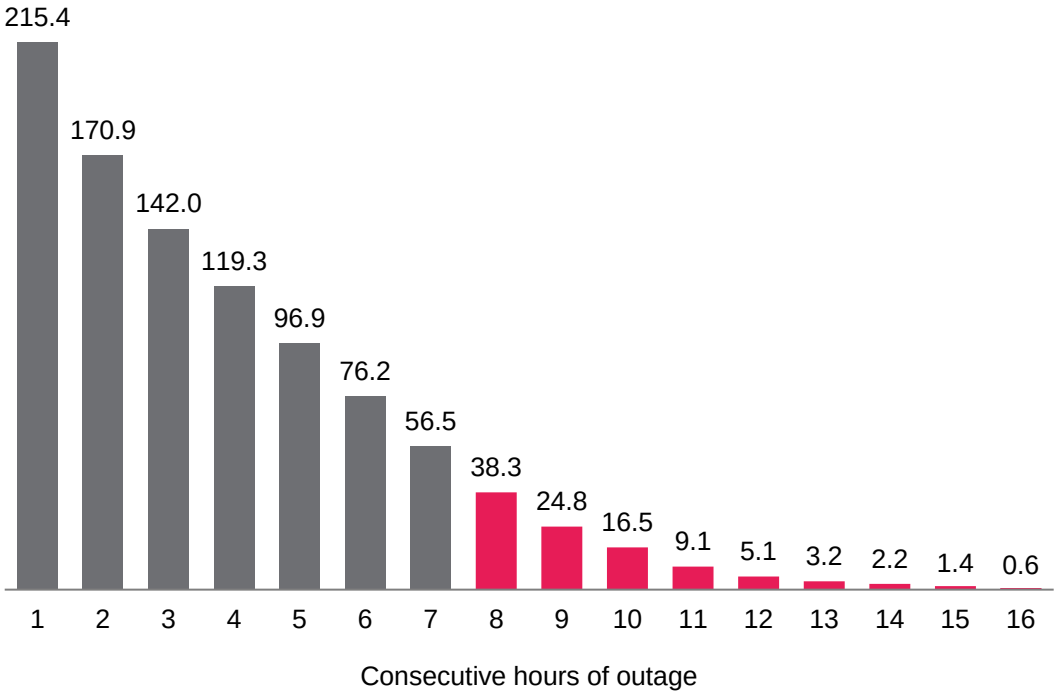



## The infrastructure is in place

- ✓ APA owns and operates Pipeline Infrastructure in WA with a combined pipeline capacity in excess of 440TJ/day (160PJ pa) that is capable of being expanded.
- ✓ APA's West Coast Grid has been expanded (via looping and compression) several times over the last decade providing reliable energy, supporting growth in the resources sector in WA.
- ✓ The Northern Goldfields Interconnect (NGI) was commissioned in June 2023 allowing access to both Carnarvon Basin and the emerging Perth Basin gas fields for the resources sector.
- ✓ APA can also provide gas storage services to support the energy transition, such as gas portfolio management, security of supply, gas firming and managing 'take or pay' gas supply contracts and gas storage (Mondarra has 18PJ of storage available).
- ✓ APA's pipelines have supported traditional commodities such as Iron Ore, Gold and Nickel and are now also supporting transition metals projects such as Lithium and new commodities such as Potash.
- ✓ In a high renewable world, gas transportation services will range from zero to 100% MDQ from day to day – APA is well placed to assist the resources sector manage gas to support the maximum penetration of variable renewable energy in the energy transition.

# Key challenges – Renewable intermittency and storage

## Pilbara VRE droughts of more than 8 hours occurred on average ~101 times per annum over the last 11 years[1]




## Thermal power will be needed to balance supply

- **Mining operations require firm uninterrupted sources of supply**
- Solar and wind experience renewable “droughts” which are more challenging to address in the Pilbara than in the NEM or WEM
- Mines will not be able to operate with a renewable run of resource profile and retain its current globally competitive cost structures.
- Conventional Long-duration energy storage LDES technologies are not commercial or suited to the Pilbara, which means gas will need to balance supply.
- Batteries are essential in supporting renewables, however, using BESS systems for LDES is a significant economic impediment.

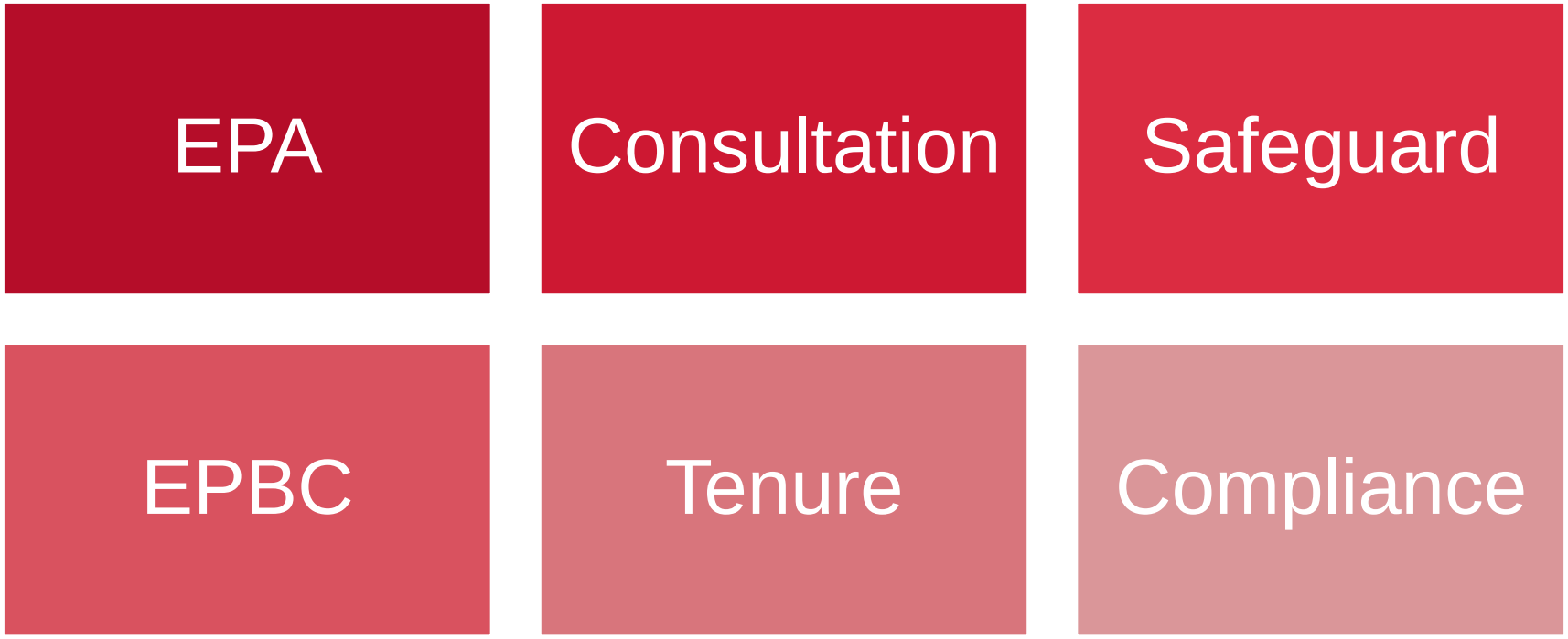
**Gas fired generation remains critical in the context of Pilbara mining to both manage renewable intermittency and maintain customer security of supply**

**Notes**

1. BCG analysis for APA. Based on 2012 to 2022 inclusive of weather data at single point in Pilbara where capacity factors of both wind and solar PV are less than 10%.

# Key challenges – Time for Tenure and Approvals

**Government policy (State and Federal) changes frequently, is often inconsistent, driving up risks and costs**
**Almost every law in the past 10 years has had the impact of either increasing cost and/or time to commercial operations**
**For wind in the Pilbara there are not that many sites that are suitable not impacted by cyclonic winds**



# Questions

## For further information

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