

# ***Hexagon's Pedirka Clean Hydrogen Project Pre-Feasibility Study (PFS) Findings***

***28 February 2022***

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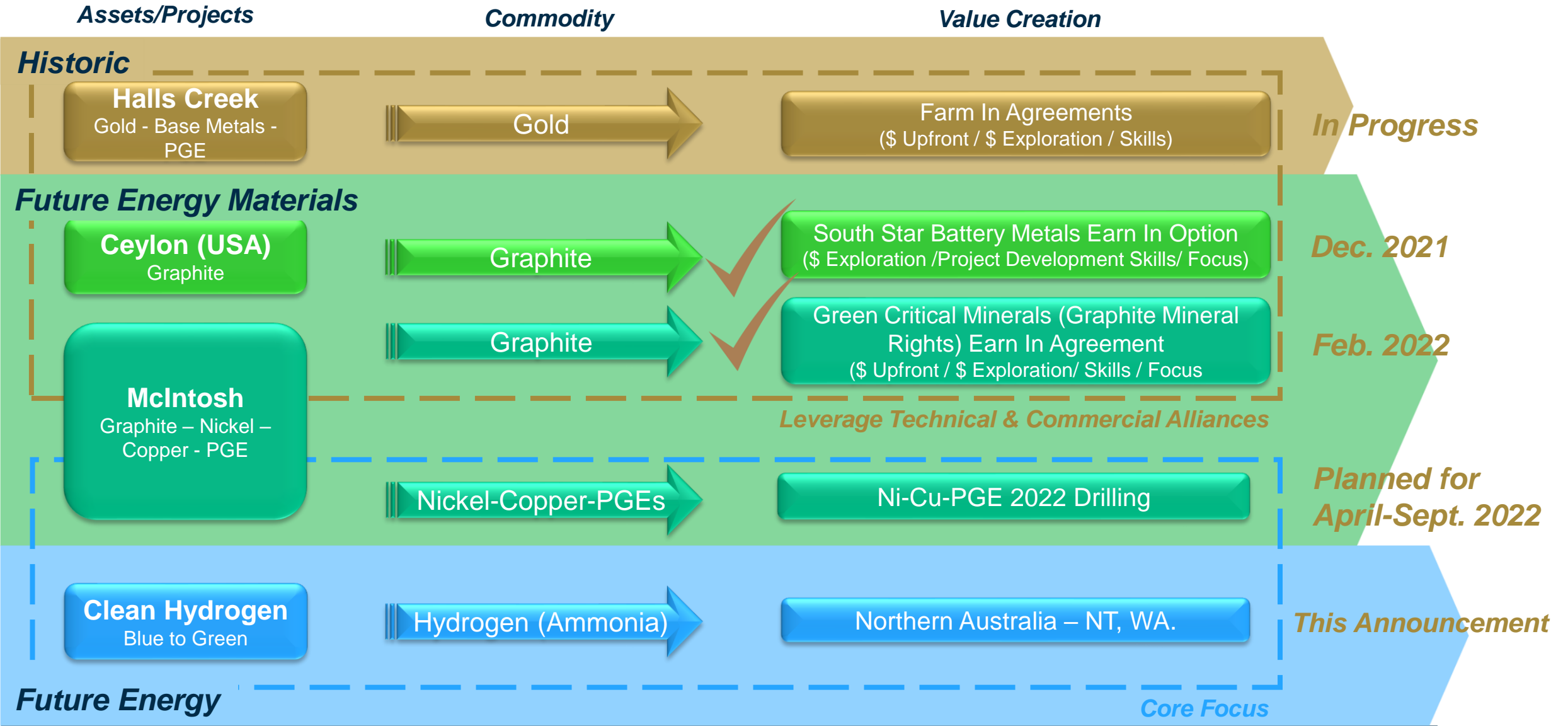
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# Executive Summary



- Pedirka clean Hydrogen PFS which commenced in April 2021 is now complete.
- Range of findings and insights gained through the PFS scope of work addressing:
  - Engineering & design across plant, equipment & supporting infrastructure, by Genesis Energies, part of Technip Energies;
  - Key financial model inputs through multiple Studies by experts including in relation to:
    - Transportation, material handling & storage (feedstock logistics);
    - Plant constructability options;
    - Environmental approvals;
    - Water supply options; and
    - Coal feedstock and mine planning.
  - Third party CCS toll service costs through discussions with potential providers.
- These Pedirka PFS outcomes provided reliable inputs into financial model covering multi-locations - Alice Springs (base case) and Middle Arm, Darwin.
- Expanded PFS scope assessed alternative locations, feedstock sources and technologies.
- Contrary to the base case outlined in the scoping study, sourcing feedstock from Pedirka is not Hexagon's most commercially attractive option for moving forward in clean Hydrogen.



Northern WA combines plentiful energy availability with well established infrastructure including for CCS

**Natural Gas Feedstock**

- Australia’s largest offshore oil and gas resources.
- Well established Dampier to Bunbury (DB) NGP provides ready access to domestic gas.

**Land, Infrastructure and Services**

- Well established oil, gas sector with access to electricity, water and services.

**Renewable Energy**

- Highest concentrated solar power capacity factor in Australia.
- Intermediate wind region and generation capacity along the coast (in conjunction with tropical cyclone challenges)

**Sustainable CCS**

- Proven CO<sub>2</sub> storage sites at advanced stages of toll CCS business model development.



Source: AusH2 Australia’s Hydrogen Opportunities Tool, Australian Government Geoscience Australia, <https://portal.ga.gov.au/persona/hydrogen>



## 0.8 MTPA blue Ammonia clean Hydrogen project situated in North Western Australia

### ***Progress achieved to date***

1. A land lease (80 ha) application made to WA Government at Onslow (in the Ashburton North Strategic Industrial Area (SIA)) with this application to be expanded to other areas based on recent government agency discussions;
2. Natural gas supply (hydrogen plant feedstock) negotiations underway – brokerage agreement signed;
3. Initial blue Ammonia Steam Methane Reformation (SMR) [proven technology] Plant and Equipment (P&E) including CO<sub>2</sub> compression for CCS and ancillary infrastructure - cost estimates for 0.8 MTPA and 0.25 MTPA plants completed by Genesis Energies;
4. Third party CCS toll treatment negotiations, with well established businesses under a CA, progressing;
5. Memorandum of Understanding with FRV Australia (24 January 2022 ) to be expanded to renewable energy and green hydrogen opportunities relating to this project;
6. Blue Ammonia sales/offtake discussions with potential customers including global trading houses underway;
7. Strategic partnership/investor discussions progressing; and
8. Key stakeholder discussions with WA Government, local suppliers, infrastructure operations & others.

## Pedirka PFS Outcomes



Development of large scale, commercial, clean hydrogen project delivering into global export markets

## *Pedirka ASX Announcements*

No.	Title/Heading	Date of Release
1.	Ebony Energy Ltd Acquisition (Takeover)	21 Dec 2020
2.	Bidders Statement for Off-Market takeover bid for Ebony Energy Ltd	16 Feb 2021
3.	Acquisition of Ebony Energy completed	23 Apr 2021
4.	Hexagon Completes \$6,200,000 (at 11c) Placement to Fund Pedirka	3 May 2021
5.	Pedirka Blue Hydrogen Project Update	19 May 2021
6.	Well-Renowned Technip Energies joins project team developing Hexagon's Pedirka Blue Hydrogen Project	24 Jun 2021
7.	Hexagon Lodges Pedirka Project Mine Management Plan (MMP)	9 Jul 2021
8.	Hexagon Advances PFS during April-June quarter	28 Jul 2021
9.	Substantial Progress Made on Northern Territory (Pedirka) Clean Hydrogen Project Pre-Feasibility Study	14 Dec 2021
10.	PFS Completion Date set for 28 Feb 2022	22 Dec 2021

## *Key Dates*

- **April 2021:** Acquisition of Pedirka (Ebony Energy Limited) Completed.
- **April 2021:** PFS commenced.
- **May 2021:** \$6.2 Million placement completed.
- **June 2021:** Genesis Energies, part of Technip Energies appointed.
- **July 2021:** Mine Management Plan in relation to drilling lodged. Delays announced October 2021
- **December 2021:** Substantial engineering design and costing, raw materials transport, handling and design and costing, as well as decarbonisation option assessment and commercial analysis progress made. With a number of opportunities identified and also assessed including alternative feedstocks.
- **January/February 2022:** Strategic partnership agreements progressed (e.g. FRV Australia 24 January 2022 Announcement) and wide ranging discussions held.
- **PFS Completion/Close out date of 28 February 2022 (today)**

## PFS progress versus critical success factors at PFS completion

### Northern Territory (Pedirka) Hydrogen Project Pre Feasibility Study (PFS)

✓ 01 ›

Engagement with governments and other stakeholders to ensure projects continue to be consistent with hydrogen strategies for export and domestic markets. Also so regulated approvals are cost effectively completed within commercial timeframes e.g. working with Environmental Protection Authority (EPA) and other regulators.

✓ 02 ›

- a) Identify a technology partner for gasification process or other hydrogen production technologies.
- b) Determine whether hydrogen or hydrogen derivatives (carriers) such as ammonia are the best route to market – short, medium and long term.

03 ›

- ✓ a) Determine coal resource and hydrogen production potential.  
*Not Completed*  
Drilling program aimed to establish JORC Compliant Resource.
- ✓ b) Identify other feedstock options/opportunities.

✓ 04 ›

Develop carbon capture and storage and utilisation (CCS/CCUS) solutions to ensure sustainable production of blue hydrogen end product.

✓ 05 ›

Determine optimal supply chain for transportation of raw materials, as appropriate, and end product (pipeline, rail, road, sea). Working with owners and operators.

✓ 06 ›

- a) Progress customer discussions over offtake incorporating competitive cost of delivery to end markets.
- b) Progress funding/financing of entire projects (into operation) including strategic partnerships.

✓ 07 ›

Progress financial modelling and commercial analysis.



Development of large scale, commercial, clean hydrogen projects. Delivering into global export markets.

Source: Adapted 9 July 2021 and 20 January 2022 AGM Presentation ASX Announcements

## 1. Plant Engineering and Design.

- High Level energy, mass and carbon balances and for a 1.6 MTPA Coal Gasification plant at Brewer Industrial Park in Alice Springs and at Middle Arm, Darwin and 0.8 MTPA Steam Methane Reformation (SMR) at Middle Arm
- CapEx (Equipment list by plant section) and OpEx estimates.
- Footprint/Site size (No plant layout/arrangement - requested).

## 2. Specialist Consultant reports.

- Water supply options for multiple plant locations including at Pedirka.
- Constructability option workshop and assessment (Pre-fab/Modular vs. “Stick build”)
- Drill program planning, MMP application preparation and lodgment to NT Government.
- Feedstock/Coal quality and potential resource assessments.
- Mine Establishment costs and Mine planning.
- Environmental assessments – Drilling and mine related.

## 3. Stakeholder Engagement.

- NT Government.
- Landholders.
- Indigenous groups.

## 4. Transport, Materials Handling and Storage (Logistics): End-Product (NH<sub>3</sub>) to export, Coal and Plant and Equipment (P&E) by multiple plant locations. Including new transport infrastructure. CapEx and OpEx estimates.

## 5. Decarbonisation/CCS options and commercial terms.

## 6. Multi-scenario Financial model designed, built and finalised.

# Pedirka PFS raw material and end product logistics review

Transportation & Associated Infrastructure cost estimate inputs for the Pedirka Project financial model

## Middle Arm



A\$2 billion Port Infrastructure Upgrade Planned (Berthing, Channel etc related)

Source: Northern Territory Government, Investment Territory (InvestNT) Middle Arm Sustainable Development Precinct discussions

### CAPEX

1	Road upgrade
2	Spur upgrade and materials handling
3	Spur upgrade
4	Materials handling at plant (bottom rail dump, radial stacker, dozer into conveyor plant)
5	Passing loops
6	Spur upgrade and materials handling

## Brewer Industrial Park

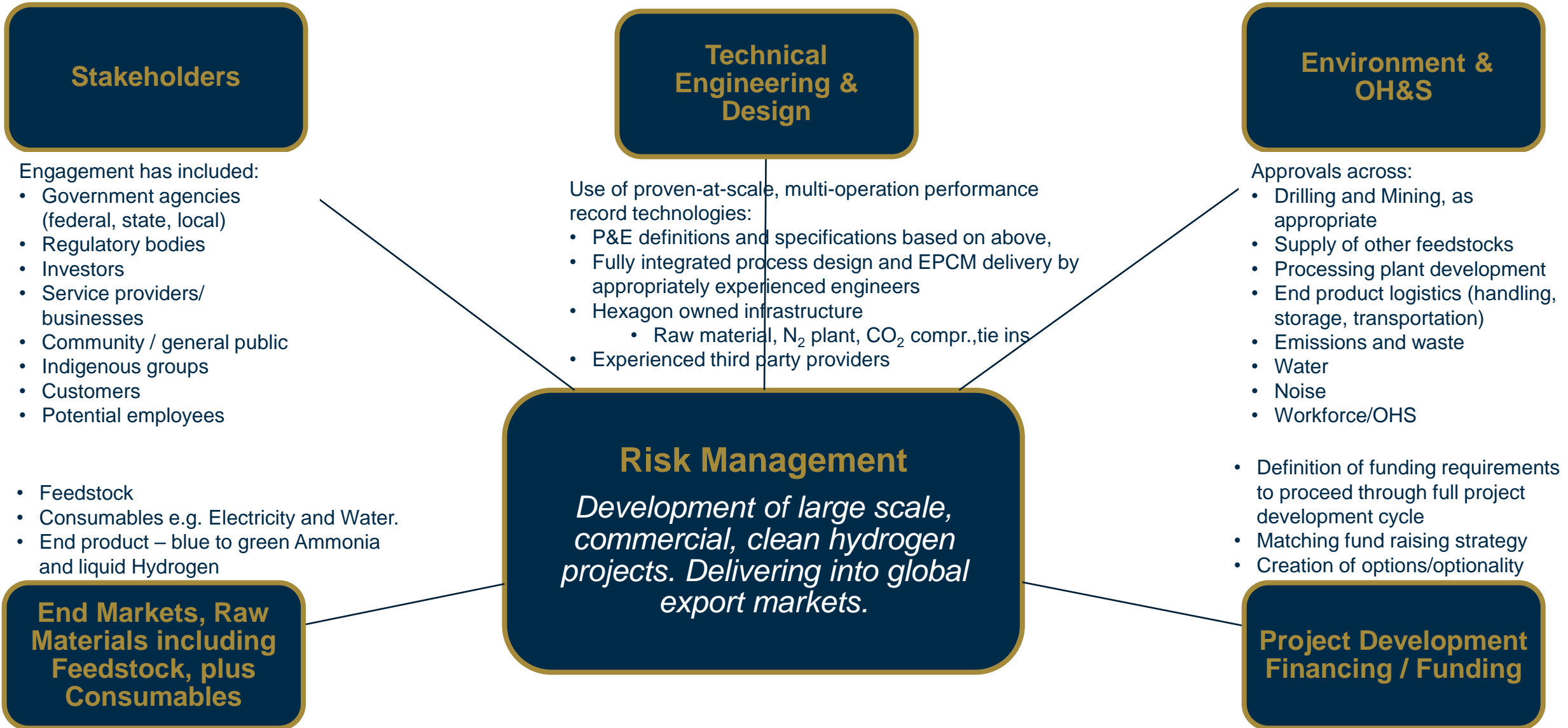


Source: www.exploroz.com/places/27958/nt+brewer-industrial-estate. ©Mavar ©Mapbox ©OpenStreetMap



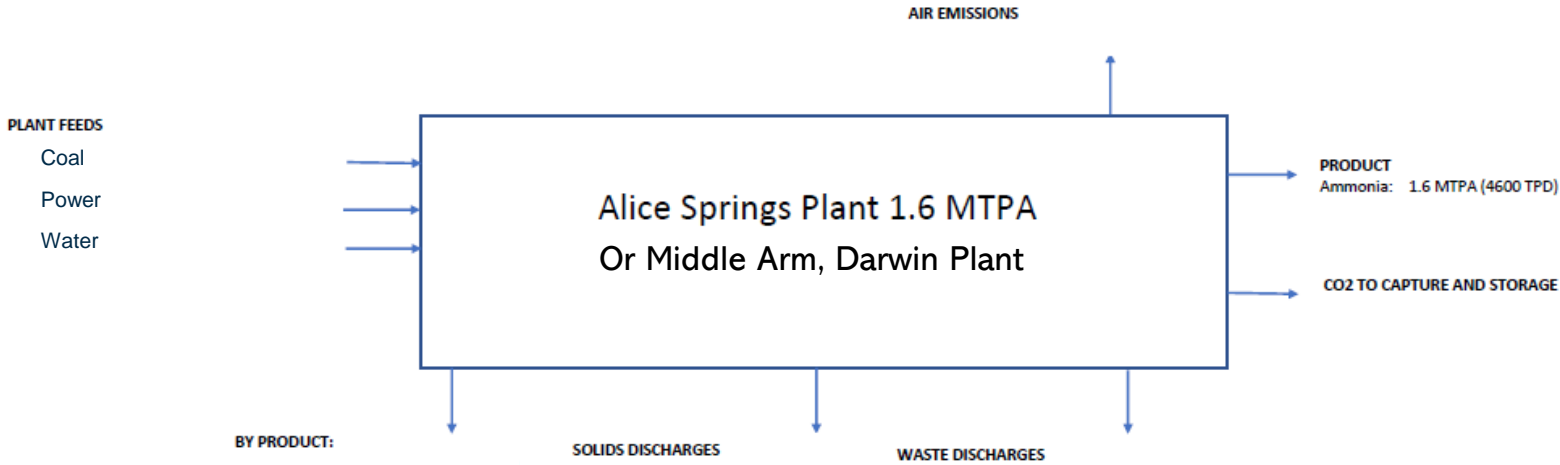


# Pedirka PFS risk management approach



Project: J41018B Pedirka Pre-Feasibility Study  
Document: J41018B-P-TN-15010  
Date: 17/11/2021

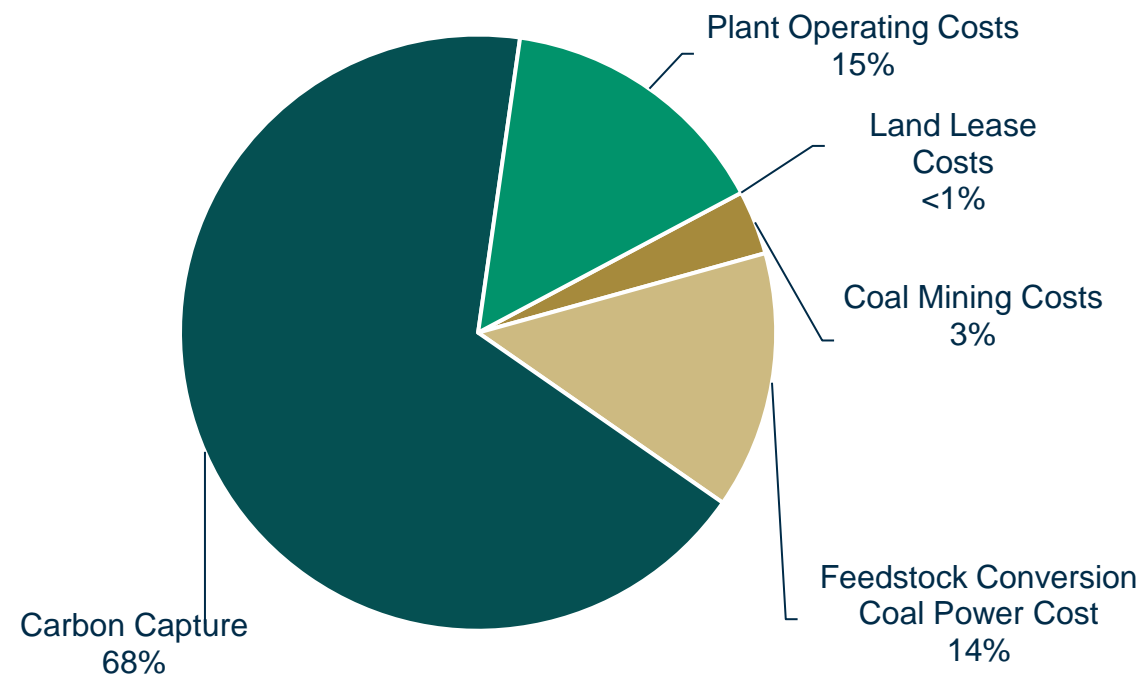
**COAL GASIFICATION AMMONIA PLANT 1.6 MTPA**



Source: Genesis Energies, 2021, adapted.

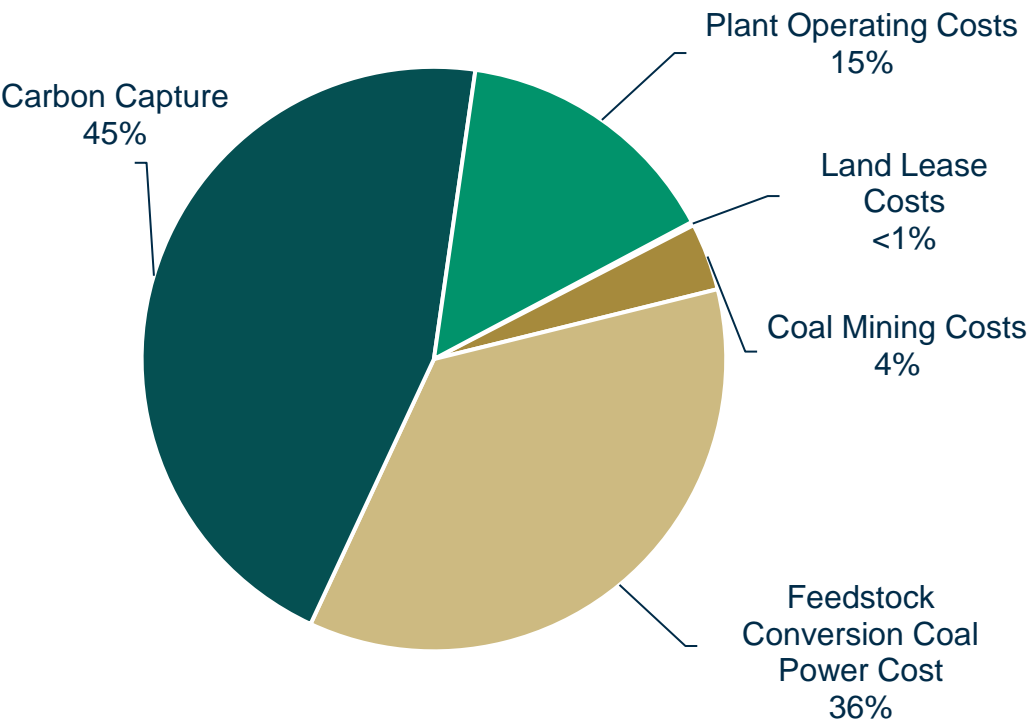
Carbon capture major operating cost element with large variance in feedstock conversion costs

*Brewer Industrial Estate, Alice Springs,  
1.6 MTPA blue Ammonia  
coal gasification with CCS plant*



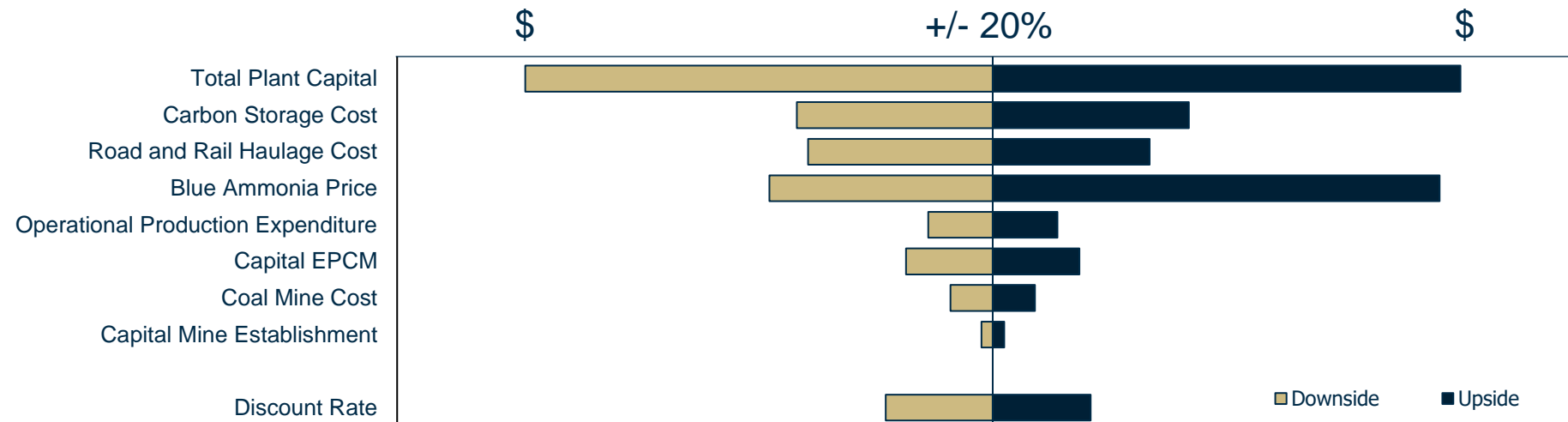
Note: Operating costs only

*Middle Arm Darwin coal gasification  
with CCS plant*



## Total plant capital and blue Ammonia price driving commercial sensitivities

- Large scale, global energy export plants are typically coastally located to minimise end product logistics costs
- First movers in emerging markets look to minimise costs by accessing already established multi-user infrastructure to the greatest extent possible
- Key project commercial return sensitivities were financially modelled as:
  1. P&E Capex;
  2. CCS toll services costs;
  3. Road and rail haulage/transportation & materials handling for coal feedstock;
  4. Ammonia prices.



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## WA's Hydrogen Advantage & Introduction of Hexagon's WA Blue Hydrogen Project





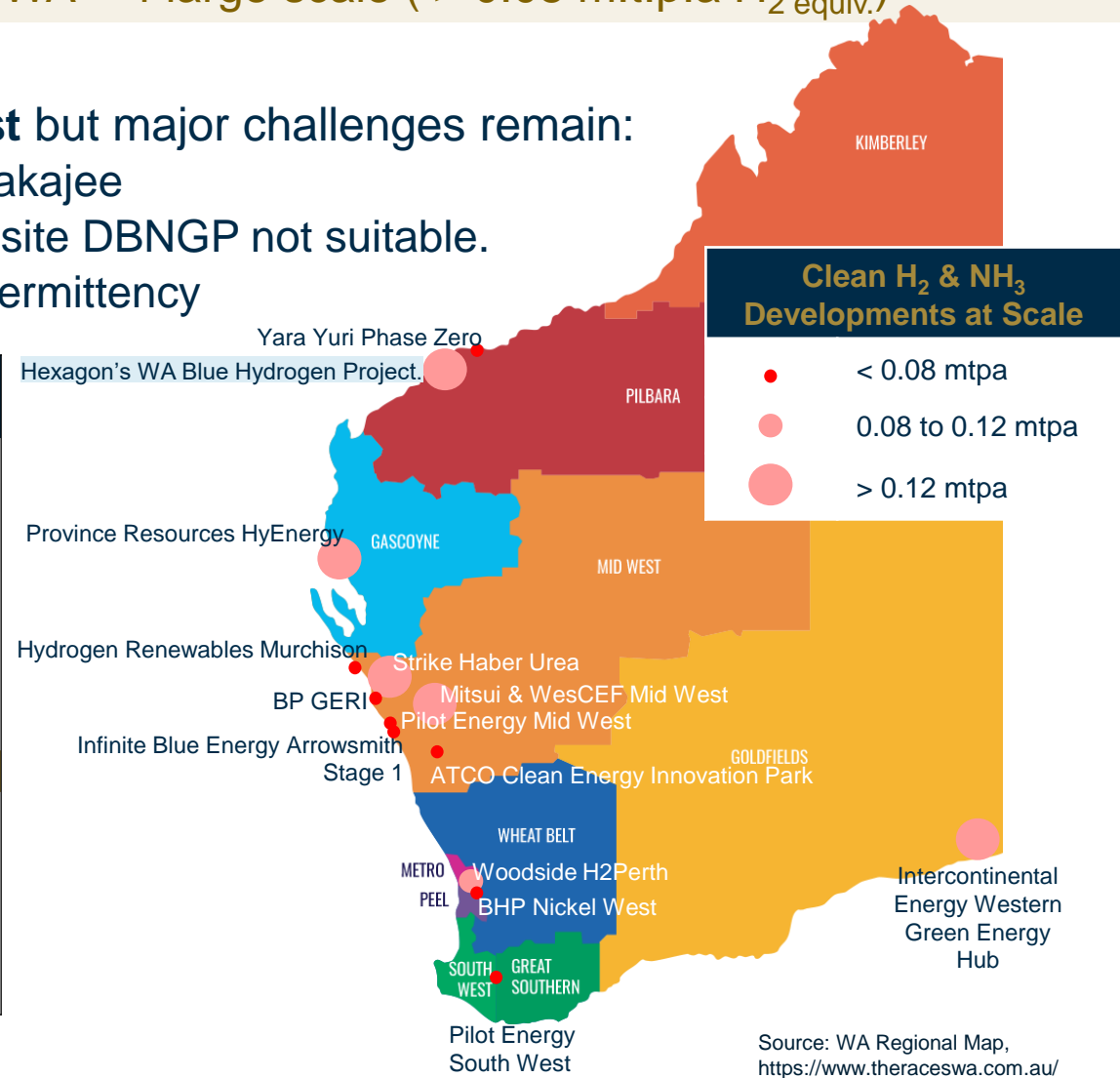
# Western Australian clean Hydrogen (H<sub>2</sub> & NH<sub>3</sub>) projects – Hexagon in context

There are 12 clean Hydrogen/Ammonia projects underway in WA – 4 large scale ( > 0.08 m.t.p.a H<sub>2</sub> equiv.)

- Plenty of green (no CCS requirements) activity in **Mid West** but major challenges remain:
  - Access to suitable major port for product export e.g. Oakajee
  - Storage, transportation and handling of H<sub>2</sub> & NH<sub>3</sub> from site DBNGP not suitable.
  - Not where the best solar renewable resources are - intermittency

Scale (Product)	Operator	Project Name	Phase
<div></div> (H <sub>2</sub> )	Province Resources	HyEnergy Project	DFS
<div></div> (NH <sub>3</sub> )	Hydrogen Renewables	Murchison Hydrogen Renewables	PFS
<div></div> (NH <sub>3</sub> )	InterContinental Energy	Western Green Energy Hub	PFS
<div></div> (NH <sub>3</sub> )	Infinite Blue Energy	Arrowsmith Hydrogen Project Stage 1	FEED
<div></div> (H <sub>2</sub> )	ATCO	Clean Energy Innovation Park	FID
<div></div> (NH <sub>3</sub> )	bp Australia	Geraldton Export Renewable Investment	DFS
<div></div> (NH <sub>3</sub> )	Woodside Energy	H2Perth	DFS
<div></div> (NH <sub>3</sub> )	Yara Pilbara	Yuri Phase Zero	In Development
<div></div> (H <sub>2</sub> )	BHP Billiton Nickel West	Nickel West Green Hydrogen	PFS
<div></div> (H <sub>2</sub> )	Pilot Energy	Mid West Blue Hydrogen	PFS
<div></div> (NH <sub>3</sub> )	Mitsui	Mid West Low Carbon Ammonia Plant	PFS
<div></div> (H <sub>2</sub> )	Pilot Energy	South West Blue Hydrogen	PFS
<div></div> (Urea)	Strike Energy	Project Haber	PFS

Hexagon's WA Hydrogen Project: 0.3 mtpa H<sub>2</sub>equiv. post Stage 2



Source: WA Regional Map, <https://www.theraceswa.com.au/>

# CCS is KEY and Northern WA is the most advanced and prospective area

Majors are developing large scale, multi-user, lowest cost CCS services in Northern WA

**Santos** ~ 3 mtpa (initial phase) expanding.

- Using Thevenard Island processing facilities and associated fields and infrastructure. Excellent on shore tie ins.

## AGIG

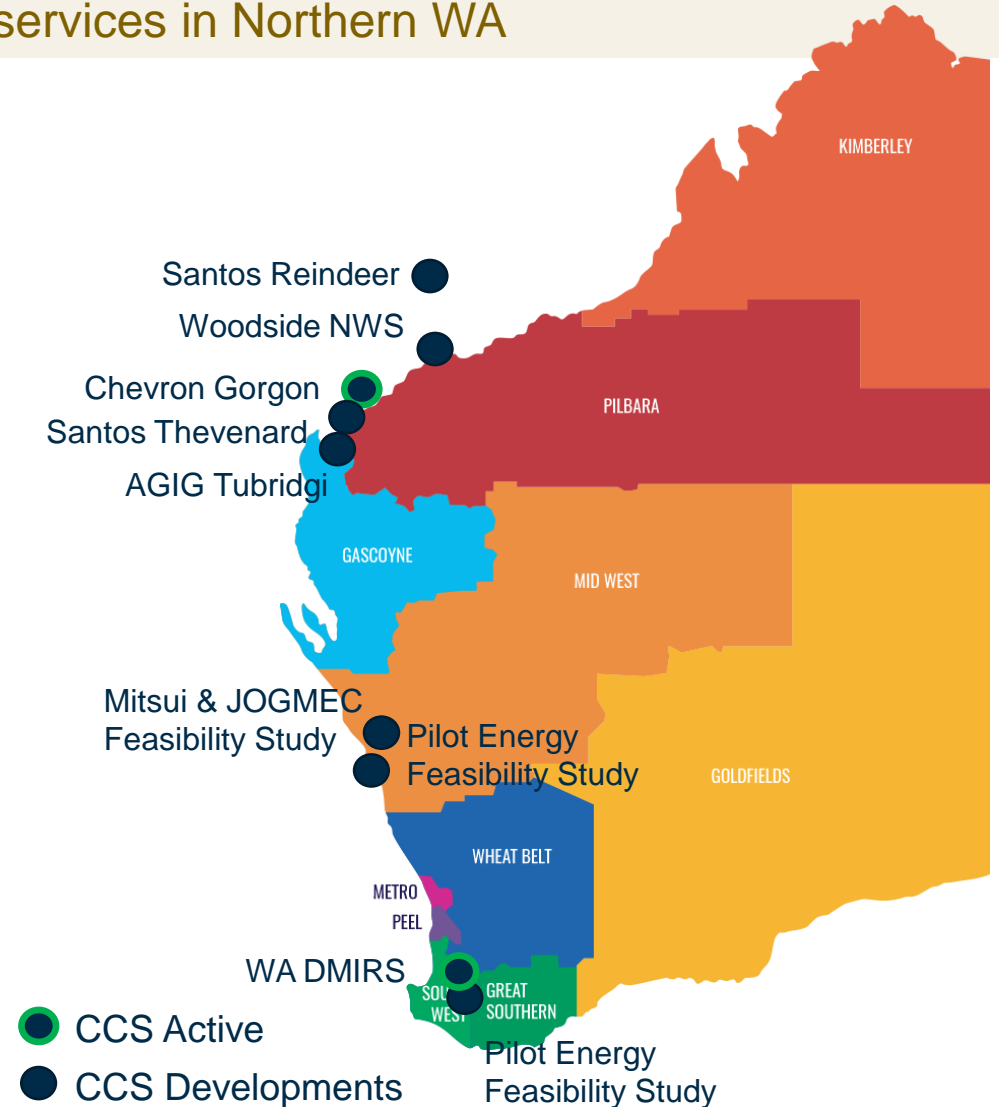
- Investigating potential to develop Tubridgi Gas field and surrounding areas. Currently used for gas storage.

## Woodside

- Progression of feasibility studies with bp and MIMI for offshore reservoirs in Northern Carnarvon Basin.

## Chevron Gorgon

- Technical difficulties in pressure management relating to adjacent water wells.
- Injection of close to 5 Mt of CO<sub>2</sub> has been achieved as of mid-July 2021.



Source: WA Regional Map, <https://www.theraceswa.com.au/>

Australia is well placed to leverage off substantial CCS experience and learnings

HEXAGON

As listed below, since the 1980’s blue Hydrogen with CCS has been successfully in use globally.

Facility	Location	Started	H <sub>2</sub> Production Capacity	H <sub>2</sub> Production Process	Hydrogen Use
Enid Fertiliser	U.S.A	1982	0.07 m.t.p.a of H <sub>2</sub> in syngas	SMR	Fertiliser production
Great Plains Synfuel	U.S.A	2000	<b>0.45 m.t.p.a of H<sub>2</sub> in syngas</b>	<b>Coal Gasification</b>	Synthetic natural gas
Air Products	U.S.A	2013	0.17 m.t.p.a of H <sub>2</sub> per day	SMR	Petroleum refining
Quest	Canada	2015	<b>0.32 m.t.p.a of H<sub>2</sub> per day</b>	<b>SMR</b>	Bitumen upgrading
Alberta Carbon Trunk Line	U.S.A	2020	<b>0.28 m.t.p.a of H<sub>2</sub> per day</b>	<b>SMR</b>	Fertiliser production
Sinopec Qilu	China	Pending	0.03 m.t.p.a of H <sub>2</sub> per day (est.)	Coal/Coke gasification	Fertiliser production

Source: Global CCS Institute, Blue Hydrogen, 2021, Hydrogen Production from Fossil Fuels with CCS (2021).

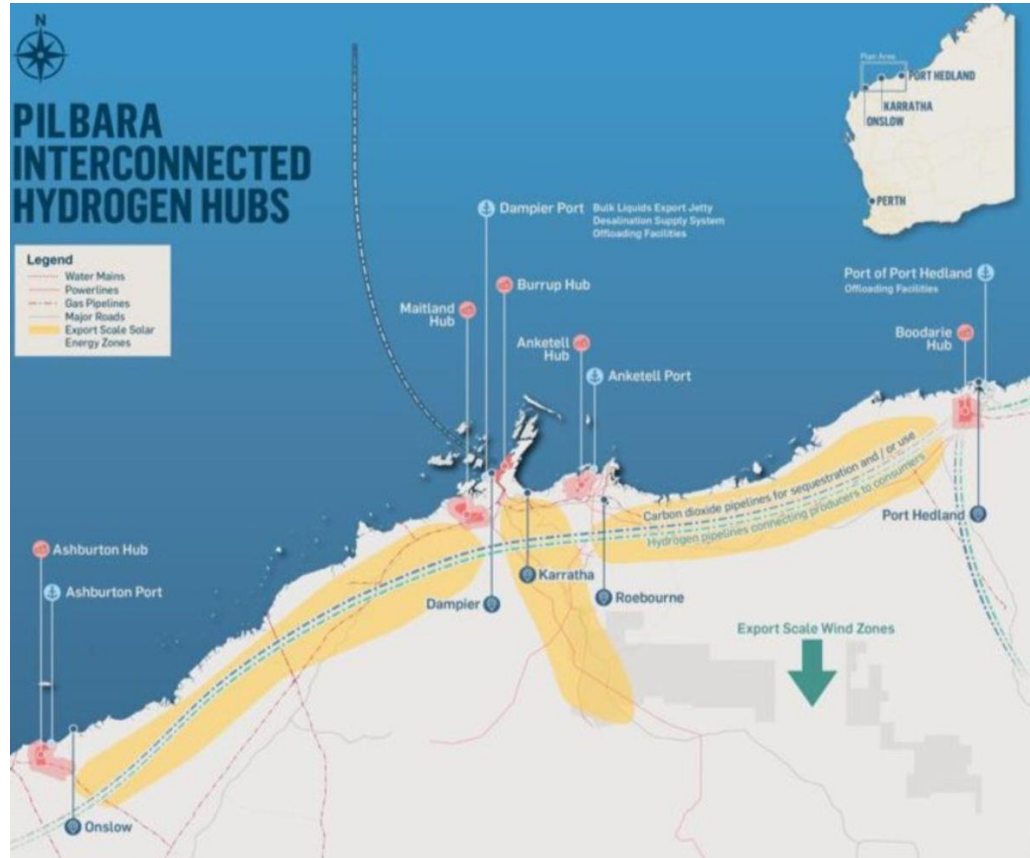


Source: Shell's Quest carbon capture and storage facility opened in 2015. <https://news.sky.com/story>

# The Pilbara interconnected Hydrogen hub

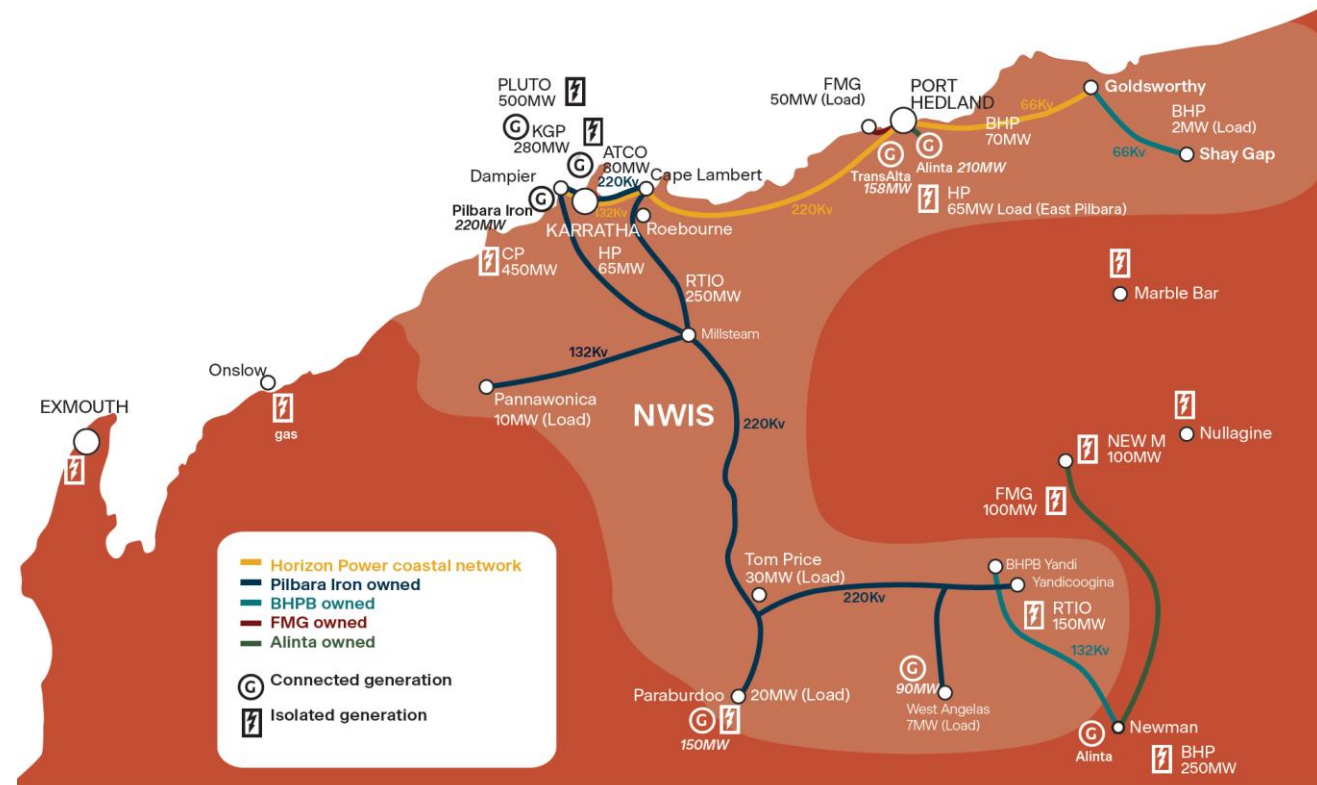
... Not only has the potential to support a substantial hydrogen sector (Blue and Green) but could strengthen and expand the NWIS, unlock gas for LNG export, decarbonise large industrials through open access to renewables.

## 'In the mix' Hydrogen Hub wise



Source: JTSI, WA Today 8/2/2022

## Renewable Energy, working with FRV, potential



Source: Horizon Power



## WA Hydrogen project agreement related discussions have commenced

- FRV has developed 9 solar farms investing + A\$1 B in Australia (800 MWdc generation capacity) to date
- 2,000 MW of renewable energy generation installed globally by FRV's parent
- Green hydrogen projects already in operation, ranging from <1MW to 20MW

### *Who is FRV in Australia?*

- Partners with OMERS Infrastructure (49%) – Potential reach through
  - Canada's largest public pension funds and global infrastructure investor
  - More than \$114 billion in net assets as at 30 June 2021
- Part of Abdul Latif Jameel Energy (51%)

***FRV Australia & Hexagon are Consortium Partners*** in an AusIndustry grant application around a Hydrogen Hub at Middle Arm, Darwin, in the Northern Territory



ASX Announcement | 24 January 2022  
Hexagon Energy Materials Limited (ASX:HXG)

MoU signed with international solar company FRV  
across potential hydrogen collaborations.



The future happens here

ned a non-binding  
le energy company,  
potential clean  
orth Western  
ralia.

**Activating a Regional Hydrogen Industry  
– Clean Hydrogen Industrial Hubs**

Project Plan

# HHDG000031

Feasibility Study in relation to

*A Clean Hydrogen Hub at  
Middle Arm, Darwin Port.*

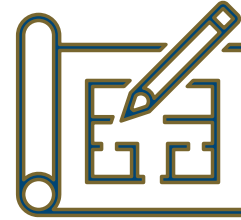
Practical and optimised establishment cost with lowest risk, underpinning potential commercial success



Strategically based in Northern Australia  
- **One of the Best Australian (& Global) Energy sources incl Renewable**



Blue Ammonia through proven SMR (conventional technology) -  
**Transitioning to green, post technology breakthroughs**



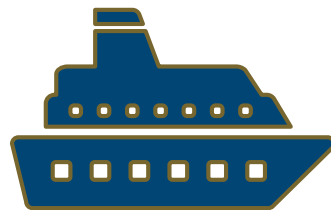
Modular Plant for rapid scale up as the **Clean Hydrogen Market Grows.**



Locally sourced natural gas feedstock - **Focus DOMgas obligations (Unlocking these for export potentially)**



Accessing local CCS  
- **Opportunity to prove cost competitiveness in Australia at scale**



Export markets  
- **Coal fired power station and Maritime vessel focus**



From the Outset use of renewable energy – **To convert feedstock to H<sub>2</sub> & CO<sub>2</sub> compression**



**Financial Model Developed**



# Considerable progress has been made by the Hexagon team



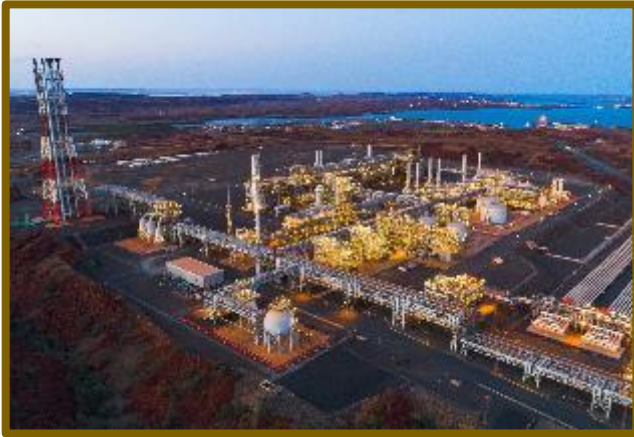
Deep local networks, market knowledge and complex integrated project development experience (incl in Hydrogen) underpinning project success.



# Financing opportunities with major Japanese trading houses

An LNG business (financing) model is likely to be adopted in Hydrogen

Taking differing equity in the whole value chain - acting as foundation Long Term LNG customer and underpinning the commercial viability of new LNG Projects. Mitsui, Mitsubishi, JERA, Sumitomo, Sojitz, Inpex & others do this.



## Minority equity position in Gas fields and LNG Plant

**Example:** JERA et al owns 10% of Wheatstone gas fields and 8% of LNG Plant

Source: [www.chevron.com/projects/wheatstone](http://www.chevron.com/projects/wheatstone)



## Equity LNG off taker and Long term third party purchaser

**Example:** JERA at Wheatstone. Equity offtake (0.7MMTPA) plus an additional 4.5MMTPA at arms length

<https://www.tradewindsnews.com/gas/two-shell-g-class-steam-turbine-lng-carriers-find-new-homes/2-1-720419>. 11 December 2019 13:27 GMT.



## Majority equity owner of Thermal Power Stations

**Example:** JERA Futtsu Power Station (5160Mw) with LNG storage and regasification

Source: Creative Commons (<https://creativecommons.org/licenses/by-sa/3.0/>)

**Example:** Wheatstone LNG equity owned by PE Wheatstone Pty Ltd (PEW) which is owned by Tokyo Electric Power Company (TEPCO), Mitsubishi Corporation and Nippon Yusen. PEW owns 10% of the field development & 8% of the LNG plant. PEW has equity LNG offtake of 700KTPA LNG per annum. Separately, TEPCO has offtake agreements for 3.5MTPA.

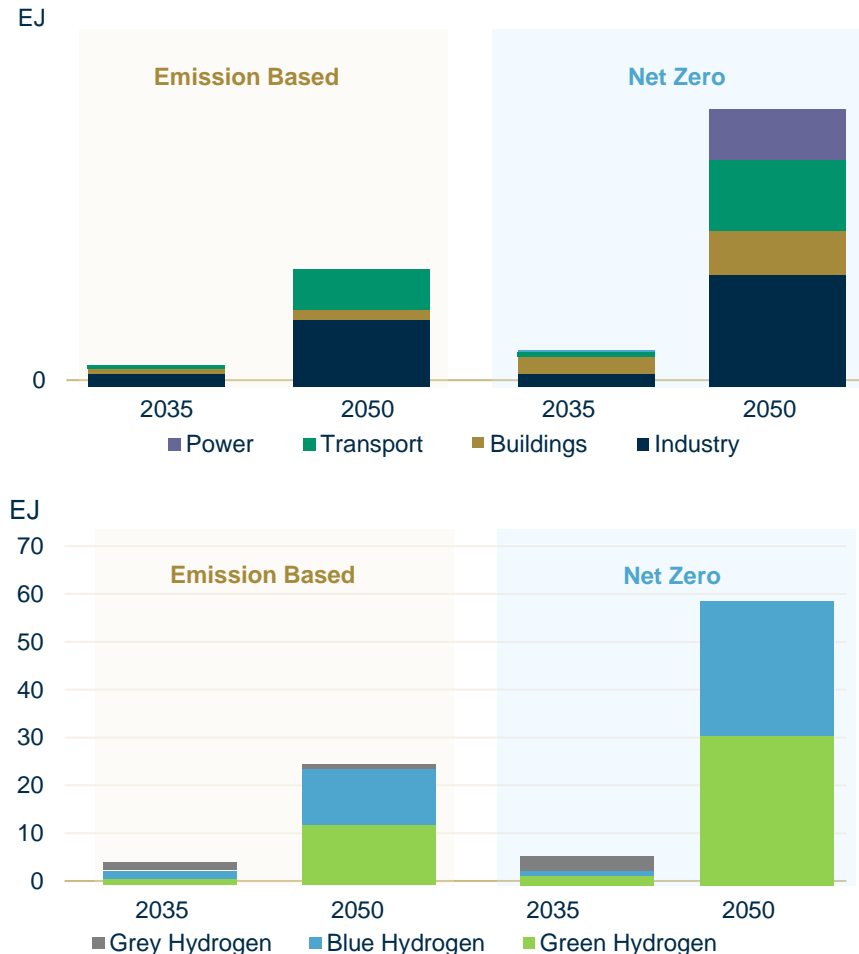
# Clean Hydrogen Market Overview





## Hydrogen is a clean, versatile energy source with strong growth in demand forecast

Hydrogen Use by Sector & Hydrogen Production by Source



Source: BP Energy Outlook 2020, <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2020.pdf>

- The global clean Hydrogen market is forecast to reach US\$300B (+A\$410B) in sales revenue by 2050\*.
- 70 m.t.p.a. (2020) base to grow by a factor of 10 by 2050\*\*.
- METI\*\*\* predicts Japanese Hydrogen consumption at 5 -10 m.t.p.a. post 2030.
- Clean Hydrogen market to add A\$11B in GDP by 2050\*\*\*\*.
- The current cost of large-scale green Hydrogen production (at +\$3.90/kg) and handling/transportation (+A\$9/kg) precludes rapid expansion\*\*\*\*\*.
- Blue Hydrogen will be key to early market growth and carbon emissions reductions.
- Ammonia as the 'Hydrogen carrier' to reduce engineering and logistical costs.

\* Source: Strategy& Part of the PwC Network, "The dawn of green hydrogen" Maintaining the (Gulf Co-operation Council) GCC's edge in a decarbonized world 2020 Report. <https://www.strategyand.pwc.com/m1/en/reports/2020/the-dawn-of-green-hydrogen.html> , F/X Source: xe.com

\*\* Source: Depending on whose market forecast you rely upon; BP, Shell, ARENA, Bloomberg NEF, McKinsey or the Australian Hydrogen Centre.

\*\*\* Source: Ministry of Economy, Trade and Industry (METI), "Basic Hydrogen Strategy" [https://www.meti.go.jp/english/press/2017/pdf/1226\\_003b.pdf](https://www.meti.go.jp/english/press/2017/pdf/1226_003b.pdf)

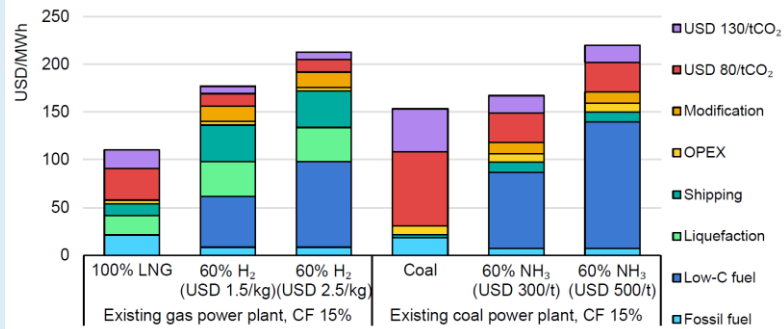
\*\*\*\* Source: Australia's National Hydrogen Strategy 2019, the Department of Industry, Innovation and Science COAG Energy Council

\*\*\*\*\* Source: Advisian Pty Ltd for the Clean Energy Finance Corporation (CEFC) , "Australian Hydrogen Market Study" May 2021 <https://www.cefc.com.au/media/nhnhwlxu/australian-hydrogen-market-study.pdf>

Hexagon's focus is Clean Ammonia (NH<sub>3</sub>) for Coal fired power stations and Maritime fuels

## Coal Fired Power Stations

Existing thermal power plants' levelised cost of energy with co-firing, 2030



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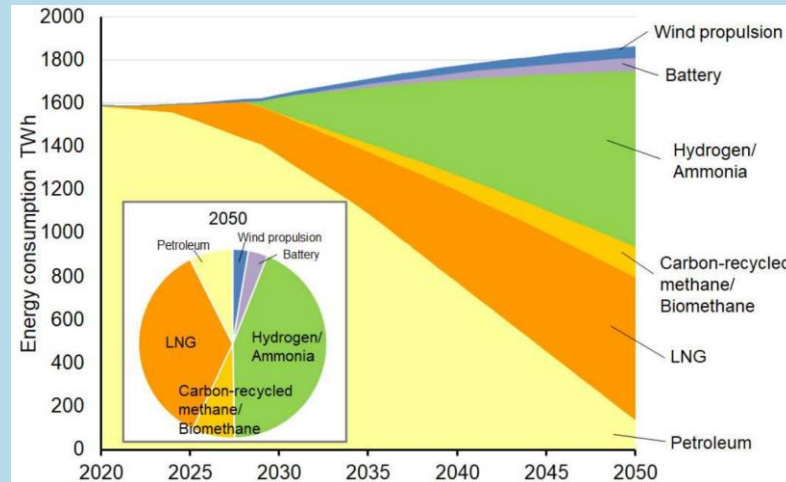
Notes: LNG = liquefied natural gas. CF = capacity factor. Low-C fuel = low-carbon fuel. Techno-economic assumptions available in the Annex.

- Co-firing of Ammonia to reduce emissions while simultaneously maintaining all services of existing fleet.
- JERA targets 50% Ammonia-Coal co-firing by 2030 (4 x NEDO projects).
- 100% Ammonia in 2040s potential

Source: IEA, 2021, Global Hydrogen Review 2021

Source: Ammonia Energy Association, 2022, JERA Target 50% Ammonia-Coal Co-Firing by 2030

## Fuels - Maritime

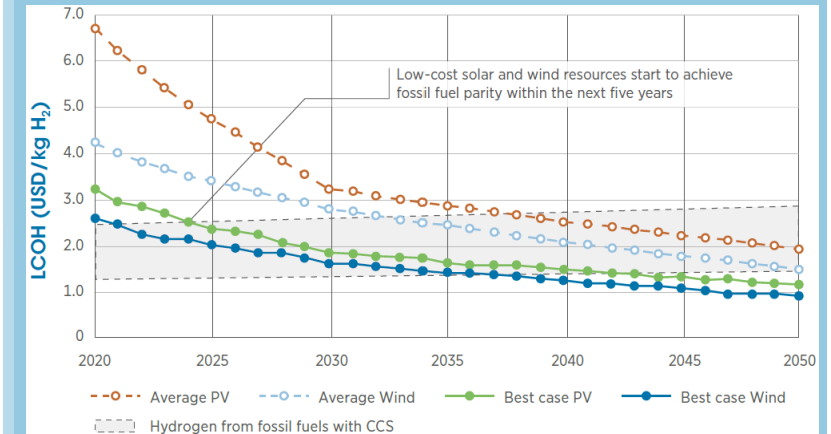


- Fuel flexible combustion engines under development.
- 100% Ammonia-fueled maritime engines by 2023. +40% of maritime vessels NH3/H2 by 2050
- Japan target first generation zero emission ship by 2028.

Source: MLIT, 2020, Roadmap to Zero Emissions from International Shipping

Source: IEA, 2021, Global Hydrogen Review 2021

## H<sub>2</sub> & Renewable Energy Storage



- Renewables intermittency can be addressed through H<sub>2</sub> storage and Fuel Cell generation to meet 24/7 demand – Cost down critical.

Source: IRENA, 2019, Hydrogen: A Renewable Energy Perspective

Hexagon's **DCAmmonia** unlocking global carbon abatement targets as new, clean fuel source

## Coal-Fired Power Stations



Source: JERA's Hekinan thermal power station in Hekinan, REUTERS/Yuka Obayashi  
<https://www.reuters.com/business/energy/hooked-coal-power-japan-aims-ammonia-fix-2021-10-29/>

### CO-FIRING DECARBONISED AMMONIA IN COAL FIRED POWER PLANTS

**OVERVIEW**

Globally, coal is the largest source of energy for electricity generation (43% in 2021, IEA). Coal-fired power plants are highly cost competitive in electricity generation, they account for about 30% of global CO<sub>2</sub> emissions (2021, IEA).

Co-firing Coal-fired power plants with decarbonised Ammonia or **DCAmmonia** (Blue and/or Green Ammonia) has the potential to significantly cut carbon emissions, as Ammonia does not emit Carbon Dioxide (CO<sub>2</sub>) when burned.

THE CHEMICAL REACTION		
Coal combustion reaction:	$CH_4 + 2 O_2 \rightarrow 2H_2O + CO_2$	
	Methane + Oxygen $\rightarrow$ Water + Carbon Dioxide	
Ammonia combustion reaction:	$2NH_3 + \frac{3}{2} O_2 \rightarrow 3H_2O + N_2$	Ammonia does not emit CO <sub>2</sub> when burned
	Ammonia + Oxygen $\rightarrow$ Water + Nitrogen	

## Maritime/Shipping Vessels



Source: Image Credits, c-job.com,  
<https://www.marineinsight.com/shipping-news/ammonia-as-ships-fuel-c-job-plans-future-proof-way-of-thinking/>

### USE OF DECARBONISED AMMONIA AS A MARITIME SHIPPING FUEL

**OVERVIEW**

Maritime shipping accounts for 75% of total global freight transport activity (IEA, 2021). Generally, the maritime shipping industry has used oil as the fuel source, coupled with reciprocating diesel engines due to their operating simplicity, robustness, and fuel economy. The international shipping industry represents approximately 3% of global greenhouse gas emissions (IMO, 2021). The use of decarbonised (Blue and/or Green) Ammonia or **MAmmonia** as a shipping fuel has the potential to significantly cut carbon emissions. Ammonia does not emit Carbon Dioxide (CO<sub>2</sub>) when burned.

THE CHEMICAL REACTION		
Diesel combustion reaction:	$4C_{12}H_{23} + 71O_2 \rightarrow 46H_2O + 48CO_2$	
	Diesel + Oxygen $\rightarrow$ Water + Carbon Dioxide	
Ammonia combustion reaction:	$2NH_3 + \frac{3}{2} O_2 \rightarrow 3H_2O + N_2$	Ammonia does not emit CO <sub>2</sub> when burned
	Ammonia + Oxygen $\rightarrow$ Water + Nitrogen	



Japan developing long term blue & green Hydrogen & Ammonia supply chain

COAL | ENERGY TRANSITION | NATURAL GAS | PETROCHEMICALS — 18 Feb 2022 | 04:36 UTC

## Japan's JERA eyes up to 500,000 mt/year ammonia long-term supply from FY 2027-28

### HIGHLIGHTS

JERA eyes 20% co-burning of ammonia at No. 4 Hekinan unit in late 2020s

Japan sees 3 mil mt/year ammonia demand for power in 2030

Japan's largest power generation company JERA said Feb. 18 it plans to issue international tenders to buy up to 500,000 mt/year of fuel ammonia from long-term contracts starting in fiscal year 2027-28 (April-March).

Source: S&P Global Platts

<https://www.spglobal.com/platts/en/market-insights/latest-news/energy-transition/021822-japans-jera-eyes-up-to-500000-mt/year-ammonia-long-term-supply-from-fy-2027-28>

## Moving Forward



# Distinct advantages in Northern WA for commercial hydrogen project



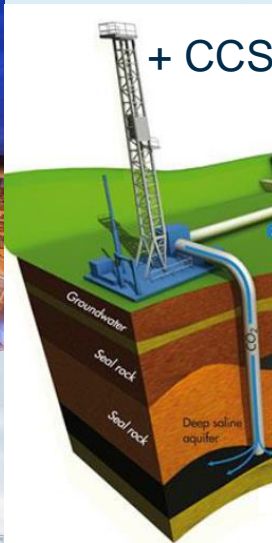
Advanced CCS third party solutions, natural gas supply options and well-established large scale infrastructure will all significantly impact Hexagon’s WAH2 project economics both short and long term

Natural Gas Feedstock	Land, Water, Infrastructure & Services	Renewable Energy	Sustainable CCS	Customer Offtake
<div><div></div><div><div>✓</div>Australia’s largest offshore oil and gas resources.</div><div>✓</div>Well established Dampier to Bunbury (DB) Natural Gas Pipeline (NGP) providing gas access.</div>	<div><div></div><div><div>✓</div>Well established oil, gas sector with ready access to electricity, water and services.</div><div>✓</div>Access to WA Government owned Strategic Industrial Areas on the coast next to major export ports.</div> <div>✓</div> Large scale, well-established and expertly operating export ports managed by port authorities.	<div><div></div><div><div>✓</div>Highest concentrated solar power capacity factor in Australia.</div><div>✓</div>Variety of renewables availability e.g. wind energy options.</div>	<div><div></div><div><div>✓</div>Proven CO2 storage sites on North West Shelf.</div><div>✓</div>Major operators/companies at advanced stages of toll CCS business model development.</div>	<div><div></div><div><div>✓</div>Multiple parties in export markets driving volume demand.</div><div>✓</div>Customer familiarity with Northern WA ports &amp; infrastructure</div> <div>✓</div> Common customers to LNG already established accessing end product in Northern WA.

# Northern Australia focus: WA Hydrogen Project

Practical, low risk and establishment cost with high potential for commercial success. Large scale, clean hydrogen project supplying domestic and global markets

## Generic



NH<sub>3</sub>

## Specific

Stage 1

- Site WA Government owned Strategic Industrial Area (SIA) application lodged.
- Gas supply and CCS negotiations underway.
- Use of renewable energy to the greatest extent possible from the outset.

Stage 2

- Modular plant allowing rapid scale up as markets grow.

NH<sub>3</sub>

## Future / Emerging

Stage 3

Incorporation of green Hydrogen

Stage 4

Transition to green Hydrogen production on commercial basis based on technology breakthroughs.

Blue to Green Transitioning

Source: Ammonia Production plant, Dreamtime (Licensed)

Source: Japan bets on ammonia as the fuel of the future, Robin Harding JULY 23 2020

Financial times <https://www.ft.com/content/254e44c4-afec-11ea-94fc-9a676a727e5a>

© ShutterstockShare.

Secure and leverage technical and commercial alliances, by commodity.  
Core future energy and future energy materials projects have central focus.

## 1. ***Future Energy: Clean Hydrogen***

- a) WA blue Ammonia Project (WAH<sub>2</sub>) priority – Update over the coming week.
- b) NT Middle Arm, Darwin clean Hydrogen long term, commercially based potential.

## 2. ***Future Energy Materials: Nickel, Copper, PGE's, Graphite***

### ***i. The McIntosh Project***

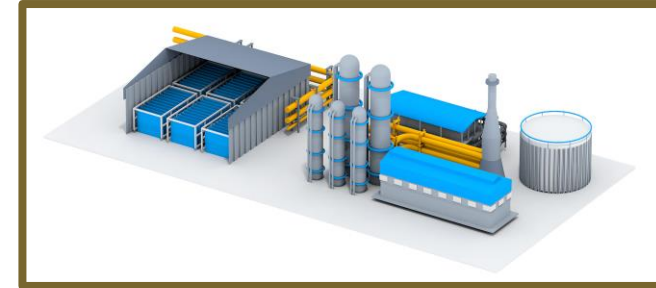
- a) Nickel-Copper-PGE: Drilling program 2022 – Updates on 2021 field work results expected shortly.
- b) Graphite value creation: Green Critical Mineral deal Feb. 2022.

### ***ii. Ceylon Graphite U.S.A.: South Star Battery Metals deal Dec. 2021.***

## 3. ***Historic Assets:***

**Halls Creek – Gold, Copper, PGE's:** Collaboration partnerships in progress.

### ***Green H<sub>2</sub> small scale plant***



Source: Thyssenkrupp, Insights Industrial Solutions  
<https://insights.thyssenkrupp-industrial-solutions.com/story/small-scale-green-ammonia-plants-open-up-new-storage-possibilities-for-wind-and-solar-power/>



### ***McIntosh sulphide mineralisation***

Source: HXG AGM Presentation 27 November 2015.



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