Transport and Infrastructure Net Zero Consultation Roadmap

Take the survey

Department of Climate Change, Energy, Environment and Water

Response received at:
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3 Published name
Alison McLean

4 Confirm that you have read and understand this declaration.
Yes

5 First name
Alison

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7 Email
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9 Who are you answering on behalf of?

Organisation

10 Organisation name

Hay Shire Council

11 What best describes you or your organisation?

Government

12 What sector do you represent?

Other: "Local Government "

13 What state or territory do you live in?

New South Wales

14 Postcode

2711

15 What area best describes where you live?

Remote area

16 1. Do you support the proposed guiding principles?

Yes

17 1.1 Please add details to your response.

From a remote location viewpoint, Principles 3 and 4 will be key to ensuring transport corridors remain and economic opportunity is maximised.

18 2. Do you support the use of the avoid-shift-improve framework as a tool to identify opportunities for abatement?

Yes

19 2.1 Please add details to your response.

From a remote location viewpoint, we would welcome support for active and public transport to support a reduction in emission. As an agrarian economy, transport is a critical input and work on producing low emission freight transport will be critical to primary production being able to reduce its scope 1,2 and 3 emissions.

20 3. Do you agree the development of a national policy framework for active and public transport will support emissions reduction?

Yes

21 3.1 Please add details to your response.

Not answered

22 4. What should be included in a national policy framework for active and public transport and how should it be developed?

Not answered

23 5. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure the movement of people contributes to transport emissions reduction?

Not answered

24 6.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure that the movement of goods contributes to transport emissions reduction?

Embrace future fuel opportunities along known transport corridor. Look at producing future fuels at strategic locations along the corridors (eg Hay in NSW) . This reduces the need to transport to the coast, uses renewable energy in situ and ensures that local communities who rely on the transport sector for economic viability continue to experience the economic activity. In June 2024, economic activity from the sale of fuel accounted for 20% of all economic activity in our economy. As fossil fuels become less viable, alternative pathways need to be investigated and funded. For example. Produce

Green Hydrogen in Hay to be used as refueling for heavy vehicles. Reduces emissions on freight transportation, avoids the need to transport fuel and ensure that the transport corridor remains viable.

25 6.2. How would these actions address the identified challenges and opportunities for emissions reduction in the movement of goods?

These measures would ensure that the transport corridors - vital to support agrarian economies remain viable.
Encourage the use of future fuels - for both transport and heavy machinery used in agriculture
Encourage the hosting of renewable energy developments in rural and remote areas

26 7. Do you agree with the proposed net zero pathway for light road vehicles?

Yes

27 7.1 Please add details to your response.

Not answered

28 8. The Australian Government is currently developing an Australian New Vehicle Efficiency Standard and has already begun to implement actions in the National Electric Vehicle Strategy.8.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce light vehicle emissions?

Fund essential infrastructure in rural and remote areas to ensure the up take of electric vehicles
Provide significant tax incentives for rural and remote Australia to up take electric vehicles where range anxiety and capability is a significant barrier
Assist Primary Produces to install infrastructure to assist in the re fueling of future fuels in heavy vehicles, such that transport/freight have on farm access to re fueling thus reducing barriers to change but also helping Primary Production to decarbonise their Scope 1 and 3 emissions.
Fund zero emissions public transport for rural communities to reduce the need for multiple individual passenger vehicles completing the same journey.

29 8.2 How would these actions address the identified challenges and opportunities to reduce light vehicle emissions?

Not answered

30 9. Do you agree with the proposed net zero pathway for heavy road vehicles?

Yes

31 9.1 Please add details to your response

Not answered

32 10. The proposed pathway for heavy road vehicles relies on a mix of battery electric, hydrogen fuel-cell and low carbon liquid fuels.Rank from 1 to 3, the order in which these should be prioritised for emissions reduction.

1: Hydrogen fuel cell
2: Battery electric
3: Low carbon liquid fuels

33 10.1 Please add details to your response. Why did you rank them in that order?

Hydrogen Fuel Cell has the potential to be produced in regional and remote areas thus guaranteeing transport corridors, access to freight and opportunity to capture economic benefit of producing fuel in situ.

34 11. What role should low carbon liquid fuels play in the heavy vehicle decarbonisation?

Not answered

35 12. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce heavy vehicle emissions?

Fund the development of Hydrogen production in rural and remote Australia - this will help with decarbonization of primary production (Scope 1 and 3), eliminate the need to transport Hydrogen over vast distances and thus reducing costs and ensure that small local economies can profit from the decarbonization of heavy transport. Hay (NSW) has produced a fully scoped business plan which outlines our pathway to Green Hydrogen Production.

36 13. Do you agree with the proposed net zero pathway for rail?

Yes

37 13.1 Please add details to your response.

Not answered

38 14. The proposed pathway for rail relies on a mix of battery electric, hydrogen fuel-cell and low carbon liquid fuels.Rank from 1 to 3, the order in which these should be prioritised for emissions reduction.

1: Battery electric
2: Hydrogen fuel cell
3: Low carbon liquid fuels

39 14.1 Please add details to your response. Why did you rank them in that order?

Not answered

40 15. What role should low carbon liquid fuels play in rail decarbonisation?

Not answered

41 16. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce rail emissions?

Re engage rail freight corridors that are currently closed. This will reduce the need for heavy road transport and allow for the decentralization of industry into rural and remote areas that are currently out of scope because of the costs associated with road transport.

42 16.1 How would these actions address the identified challenges and opportunities to reduce rail emissions?

Not answered

43 17. Do you agree with the proposed net zero pathway for maritime?

Yes

44 17.1 Please add details to your response.

Not answered

45 18. The Australian Government is engaging in consultation as part of the development of the Maritime Emissions Reduction National Action Plan and those consultations will also inform the final Roadmap and Action Plan. 18.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce maritime emissions?

Not answered

46 18.2 How would these actions address the identified challenges and opportunities to reduce maritime emissions?

Not answered

47 19. Do you agree with the proposed net zero pathway for aviation?

Yes

48 19.1 Please add details to your response.

Sustainable Aviation Fuel offers an opportunity to help both transport and Primary Production to decarbonise through the use of bio mass. This is another opportunity to produce future fuels in rural and remote Australia.

49 20. The Australian Government has already engaged in consultation on aviation decarbonisation through the development of the Aviation White Paper and those consultations will also inform final Roadmap and Action Plan.

Not answered

50 20.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce aviation emissions?

Not answered

51 21. Do you agree with the proposed net zero pathway for transport infrastructure?

Yes

52 21.1 Please add details to your response.

Not answered

53 22. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce transport infrastructure emissions and ensure that transport infrastructure is ready for and enables low-emission transport modes?

Not answered

54 22.1 How would these actions address the identified challenges and opportunities to reduce transport infrastructure emissions?

Not answered

55 23. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure the energy mix is ready to support transport emissions reduction?

Not answered

56 24. How should the use of low carbon liquid fuels (LCLFs) be prioritised across different transport modes over time to achieve maximum abatement?

Not answered

57 25. What are the best ways for the Australian Government to work collaboratively with industry, business, governments and communities to implement the proposed pathways?

Build capacity within communities to empower them to make and embrace change.
Support industry, through tax incentives to reduce emissions. Financially assist industries to work collaboratively to reduce emissions along their value chain (eg Transport reduces their Scope 1 emissions = Primary Producers reduce their scope 3).
Take a geographic (potentially LGA) view of emissions reduction - encourage the reduction of emissions but also account for the production of net zero energy, production of net zero fuels in an area. This encourages both sides of the equation and provides an environment that is encouraging of emissions reducing industry in partnership with traditional harder to abate industry.

58 25.1 What are good domestic or international examples of partnership and collaboration on transport and transport infrastructure emissions reduction that could inform the final Roadmap and Action Plan?

Not answered

59 25.2 What opportunities can Government leverage to show leadership in Australia and internationally?

Not answered

60 26. What measures and metrics should be used to evaluate the final Transport and Infrastructure Net Zero Roadmap and Action Plan?

Not answered

61 26.1 What other data and evidence could governments use and how could this offer further insights on the pace, scale and location of transport emissions reduction pathways?

Not answered

62 27. Do you have any feedback on the proposed review process?

Not answered

63 28. Do you have any further feedback on the Consultation Roadmap and proposed pathways?

Not answered

64 28.1 Is there anything missing? Are the sections appropriately integrated? Is the Roadmap appropriately ambitious?

Not answered

65 29. Is there any further information or documentation that you wish to be considered with your submission?

Please review the Hydrogen for Heavy Vehicles Business case for Hay. T

66 Would you like to upload a document?

Yes

67 Have you removed any identifying information from your submission?

Yes

68 Upload a submission

2023 Hay Hydrogen Business Case.pdf

69 Upload a submission

Not answered

70 Upload supporting file

Not answered

71 Upload supporting file

Not answered


Green Hydrogen Production for Heavy Vehicle Transportation in Hay Shire Council

Business Case

31st August 2023

Advisian
Worley Group

advisian.com

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NOTE: Table of Contents aligned to the Regional NSW Business Case Template as far as practicable

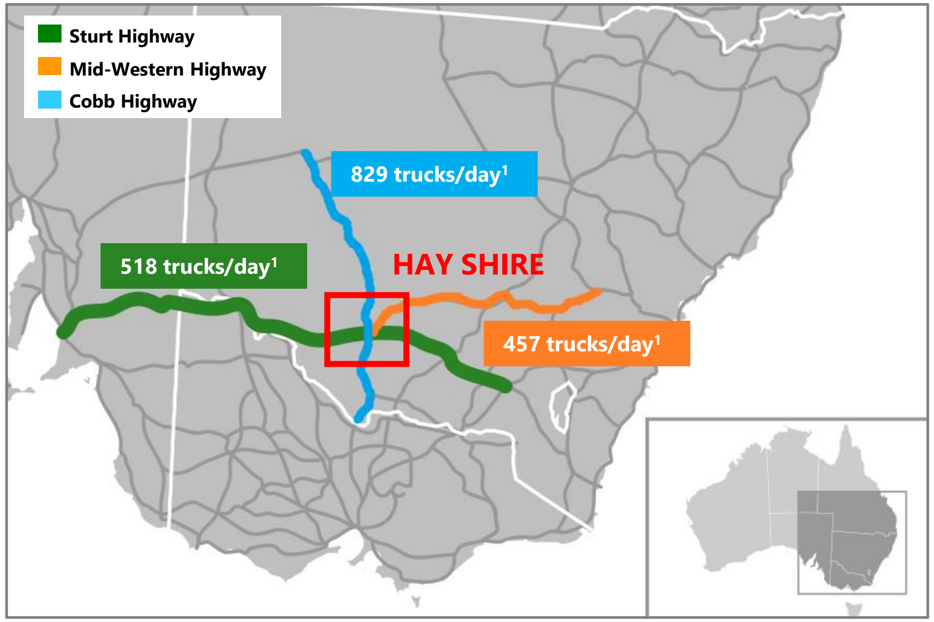
Background

Investigation and exploration of hydrogen through new technologies and sectors is a key part of the Australian Government's Long Term Emission Reduction Plan. Unlocking new demand for hydrogen will be critical to establish hydrogen supply chains and support large-scale investment into green hydrogen production infrastructure.

Hay Shire Council is looking to catalyse hydrogen uptake within rural and regional NSW by investigating heavy transportation as a potential market, leveraging its position as part of a major interstate freight corridor at the junction of the Sturt, Mid-Western, and Cobb Highways.

Targeted government support is needed to encourage industry and investors to rapidly adopt hydrogen technology, particularly where fleet operators will not buy hydrogen trucks until they have access to refuelling networks, and refuelling operators will not invest in refuelling stations until there are enough hydrogen trucks on the road. Strategic investment today will provide certainty of refuelling requirements, benefitting the sector as a whole and securing a first mover advantage to those willing to take a long-term view.

Developing a business case will provide the insight required to bring forward investment in rural and remote NSW and encourage collaboration between energy generators, government, and the transport industry.



Objectives

Develop a business case is to investigate the viability of:

- A new industry that uses available natural capital to derive wealth, economic activity, and jobs.
- A regionally located industry that will help the region and State to decarbonise the economy.
- An industry that will provide critical infrastructure to secure the transport corridor for the region as the Transport industry moves towards Hydrogen Fuel.

Desired Outcomes

- ✓ Holistic, transparent and logical assessment of a suite of options for value chain components relevant to Hay (e.g. feedstock requirements, stakeholders, partners, location, etc.).
- ✓ Definition and prioritisation of set of business delivery model options, including assessment of associated costs and benefits.
- ✓ Identification of a catalytic investment opportunity for hydrogen production for heavy transportation that contributes to decarbonisation of the regional economy without negatively impacting the Agricultural industry in Hay NSW.
- ✓ Definition of a way forward with a clear implementation pathway.

1. NFDH (2023)

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Investment rationale and expected outcomes

Leverage strategic position as part of a major interstate freight corridor to catalyse hydrogen uptake for heavy transportation and promote longevity and prosperity for the local economy in Hay Shire.

Why hydrogen?	Targets	Competitive advantage	Capabilities and partnership logic	Commercial and risk boundaries	Opportunity vision
• Hydrogen is a powerful decarbonisation lever • Hay Shire Council is well positioned to take advantage of the potential Hydrogen offers given location on the freight route, access to water and planned renewable energy projects in the region	• Target end-use sector is heavy vehicle line haul • Hydrogen to be produced and used in Hay Shire • Locations sensible for delivering Hydrogen for heavy vehicle transport (minimise impact on Agriculture)	• Proximity to the South West renewable energy zone • Access to natural capital in the form of a waste-water source • Strategic location at a junction of 3 highways: Sturt, Cobb and Midwestern	• Not looking to take on an operator role in any aspect of the value chain • Looking to act as a proponent to attract regional investment by supporting funding and planning submissions	• Prepared to take on some risk to attract private sector investments and provide certainty to Hydrogen fleet operators • Very little appetite for financial risk	• Identification of a catalytic investment opportunity for hydrogen production for heavy vehicle transportation that contributes to the decarbonisation and prosperity of the economy without negatively impacting the Agri industry in Hay NSW

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Stakeholders

A summary of key external stakeholders and their potential interests in the project

Stakeholder group	Key stakeholders	Interests
Australian Government	Department of Climate Change, Energy, the Environment and Water Department of Instructure, Transport, Regional Development, Communications and the Arts	• Alignment of the project with hydrogen and renewable energy agendas • The project's alignment with the Australian and State Government's aspiration to realise hydrogen industry potential • The management of potential project and cumulative environmental and social impacts • Project stakeholder engagement approaches
State Government	Premiers Department Department of Planning and Environment Department of Transport Department of Reginal NSW	• Alignment of the project with hydrogen and renewable energy agendas • The project's alignment with the Australian and State Government's aspiration to realise hydrogen industry potential • The management of potential project and cumulative environmental and social impacts • Project stakeholder engagement approaches
Members of Parliament	Member for Murray Member for Farrer	• The project's alignment with the Australian and State Government's aspiration to realise hydrogen industry potential • The management of potential project and cumulative environmental and social impacts • Project stakeholder engagement approaches
Local Government	Hay Shire Council	• Project description. location, scale, timing • Project's socio-economic contribution to the community • Impacts on community health and safety, infrastructure, and management measures especially in relation to workforce management planning and demand on local services. • Effective management of environmental and socio-economic (including cumulative) impacts and management measures • Project activities including construction • Voicing relevant interests and or issues that residents may have about the Project • Potential and cumulative impacts to traffic congestion, road infrastructure, visual amenity, safety and water supply • Employment, training and supply opportunities for local residents and Indigenous communities

Stakeholders

A summary of key external stakeholders and their potential interests in the project

Stakeholder group	Key stakeholders	Interests
Resource and Energy Industry Groups	National Energy Resources Australia (NERA) Australian Hydrogen Council Future Fuels CRC Clean Energy Council	• Alignment of the project with hydrogen and renewable energy agendas • The project's alignment with the Australian and states Government's aspiration to realise its potential in the hydrogen industry • The management of potential project and cumulative environmental and social impacts • Project stakeholder engagement approaches
Business and Regional Development Groups	NSW Farmers- Hay Branch Hay Plains Landcare Group Business NSW- Murray and Riverina Regional Development Australia	• Project description. location, scale, timing • Environmental and socio-economic (including cumulative) impact assessment studies completed for the project, and proposed management measures • Project consultation and engagement with the local community • Voicing relevant interests and or issues that group members may have about the project • Employment, training and supply opportunities for local residents and Indigenous communities • Workforce planning for the project
First Nations Groups	Traditional Owners Aboriginal Representative Groups Hay Local Aboriginal Land Council	• Project engagement with Traditional Owners, including in relation to agreement making and implementation, if needed. • Potential environmental and socio-economic (including cumulative) project impacts, and management measures, • First Nations employment, training and business opportunities generated and or supported by the project • Protection of Country and cultural heritage • Potential project partnerships and other opportunities for mutual benefit • Sustainable development and social investment opportunities targeted to First Nations • Performance and accountability of proponents and government departments
Community and Landholders	Residents in key project location and neighbouring suburbs Landholders Community and local interest groups Local businesses and industry in the area Education and training providers Community service providers	• Project description. location, scale, timing • Socio-economic contribution to the community • Effective management of environmental and social (including cumulative) impacts and management measures • Impacts to business operations • Potential and cumulative impacts to traffic congestion, road infrastructure, visual amenity, safety and water supply • Local employment, training and contracting opportunities.

Engagement Approach

Engagement and communications with stakeholders will be essential. The level of engagement and communications required will depend on approvals pathway and selected site.

To guide the stakeholder engagement and communications approach for the proposed project a stakeholder engagement plan will be required.

The engagement plan will detail the proposed project's approach to external stakeholder engagement, including any proposed communication tools and consultation activities.

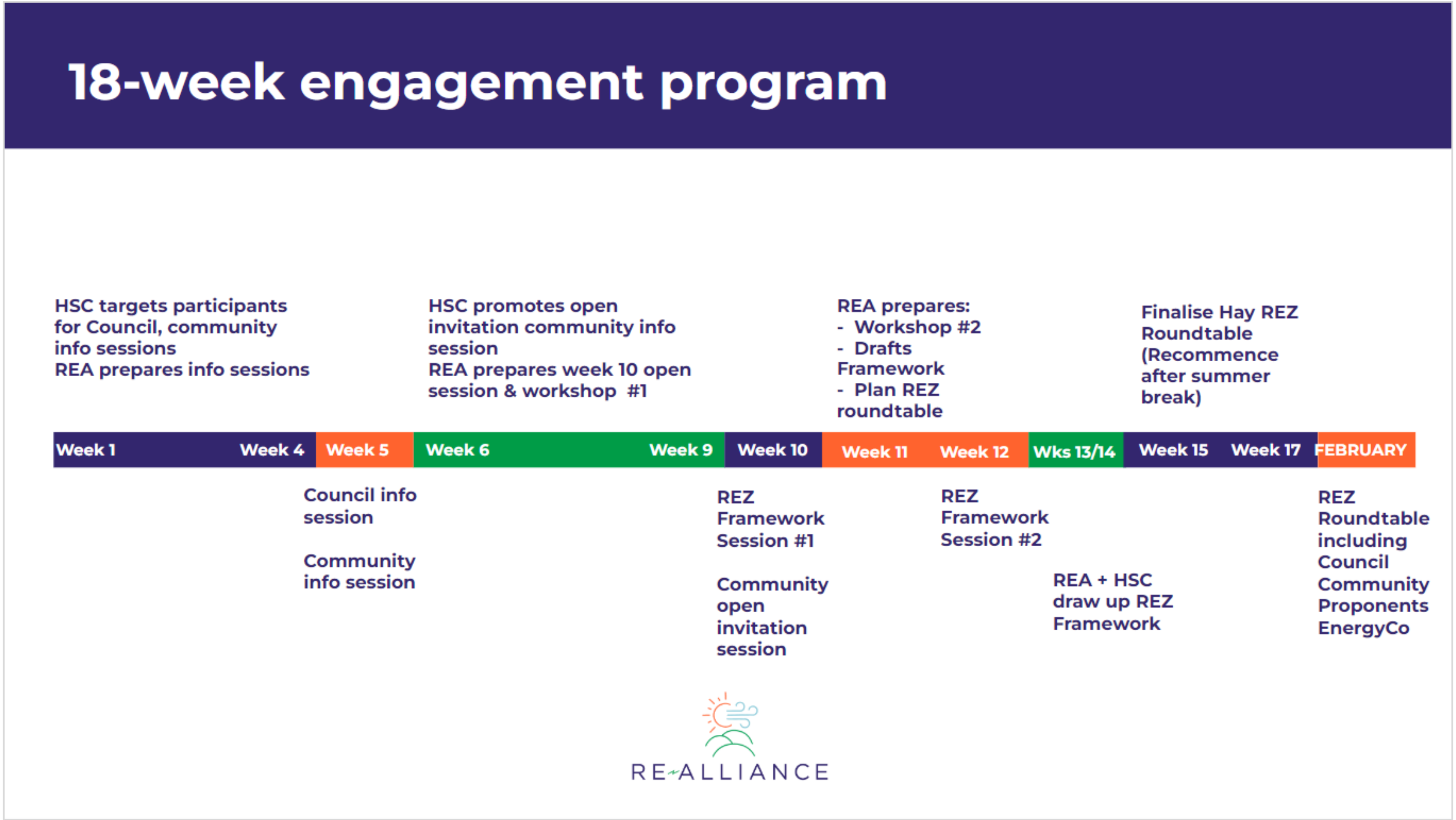
The extent of engagement and communications with stakeholders, including which stakeholders the project will need to consult with, is dependent on the project location and required approvals pathway.

Whilst the content of a stakeholder engagement plan varies from project to project, common elements include the following:

- Introduction
- Document purpose and scope
- Engagement objectives
- Relevant legislation, guidelines and principles
- Social and community context
- Stakeholder risk management
- Project stakeholders
- Engagement approach
- Communication materials
- Grievance management
- Engagement monitoring and reporting

HSC Planned Engagement Initiatives

18-week community capacity building program centred around the energy transition planned for September 2023.



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Options Development Approach

1. Location

1. Consideration of existing and developing Hydrogen Refuelling Stations (HRS) within Australia and their relation to Hay.

2. Assessment of site suitability in Hay Shire including key considerations of:

   a) proximity of renewable energy
   b) nearest water source
   c) plot size and cost
   d) geotechnical considerations for development
   e) environmental and social considerations.

Potential Site Locations assessed for suitability

Renewable Power Supply Options

Market Assessment

1. Consideration of Hay's positioning within the national freight network
2. Analysis of forecasted freight load within Hay and, subsequently, the expected truck load.
3. Analysis of expected hydrogen participation into the heavy vehicles market, and subsequently, the forecasted hydrogen powered (FCEV) truck load through Hay in 2030 and 2050.

2. HRS Design

1. Determining key functional requirements based on outcome of Market Assessment

2. Review of "standard" equipment available to allow for a generic plant sizes to be developed.

3. Options developed on how to transition between 2030 and 2050 forecasts

4. Assessment of the requisite amount of key feedstock (such as power & water) to meet the forecasted demand for Hydrogen in Hay.

HRS Size and Configuration Options

3. Business Model

1. Review of possible proponents, their likely drivers and scope

2. Identify potential partners in each category

3. Considering and assessing various delivery model configurations

Business Model Options

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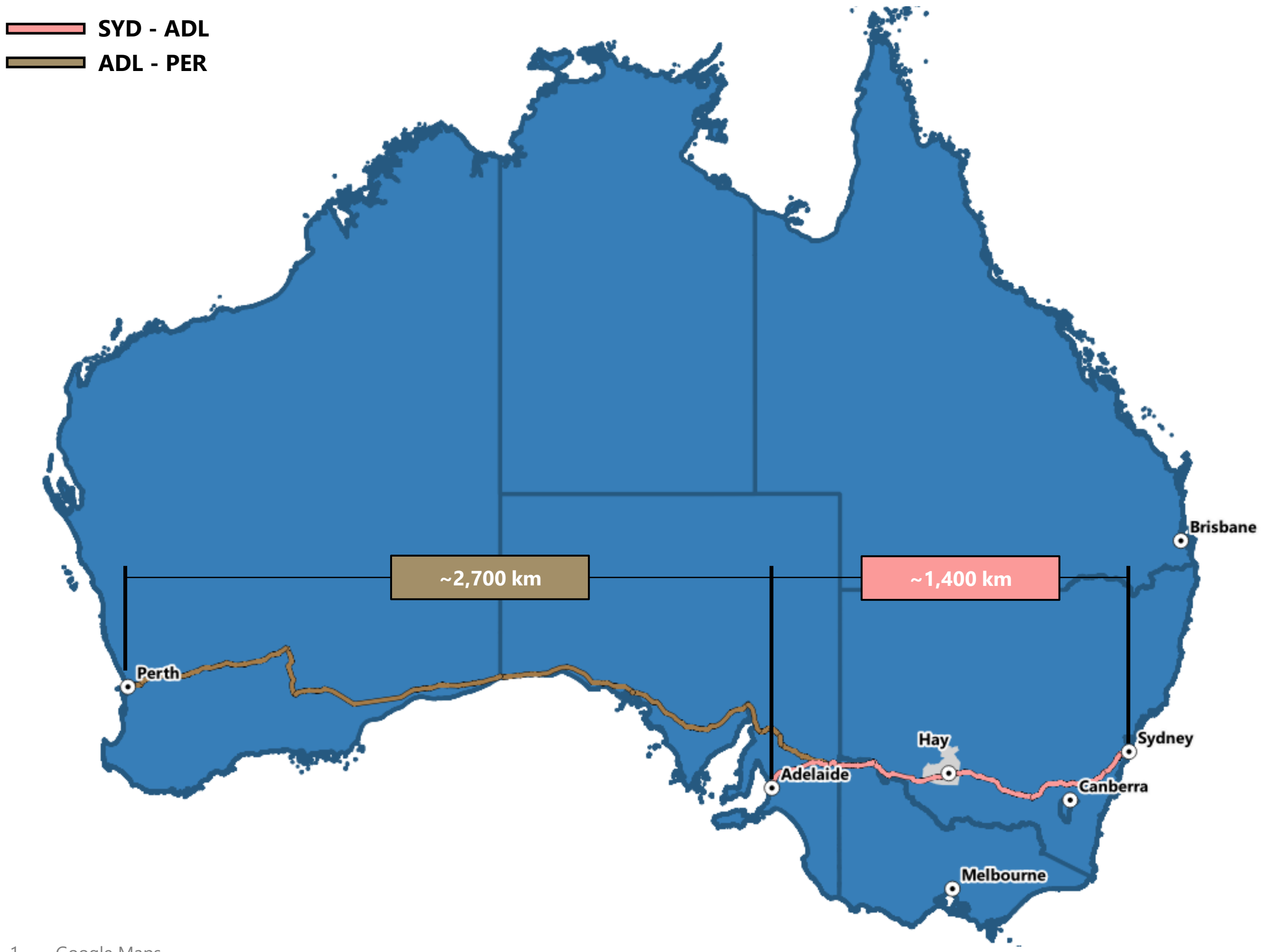
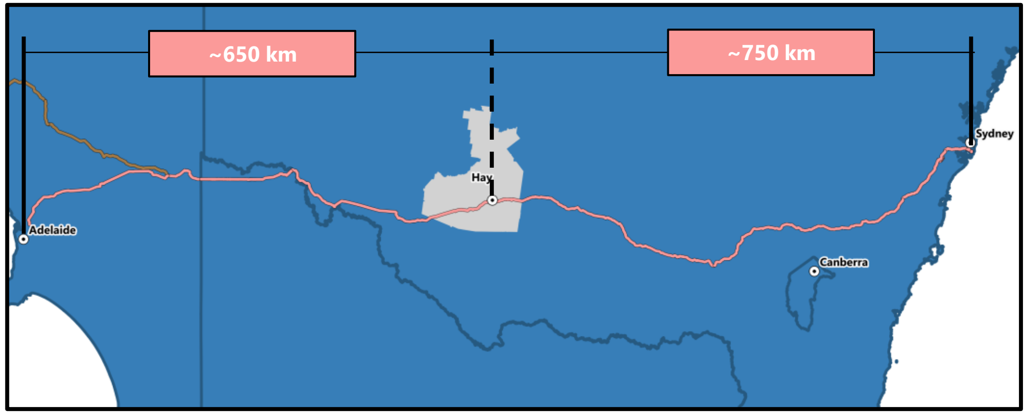
East-to-West Corridor – Distances to Hay Shire

Hay Shire is strategically placed as a gateway for the Sydney-to-Perth Freight Route and sits in the centre of the Sydney-to-Adelaide Freight Route.



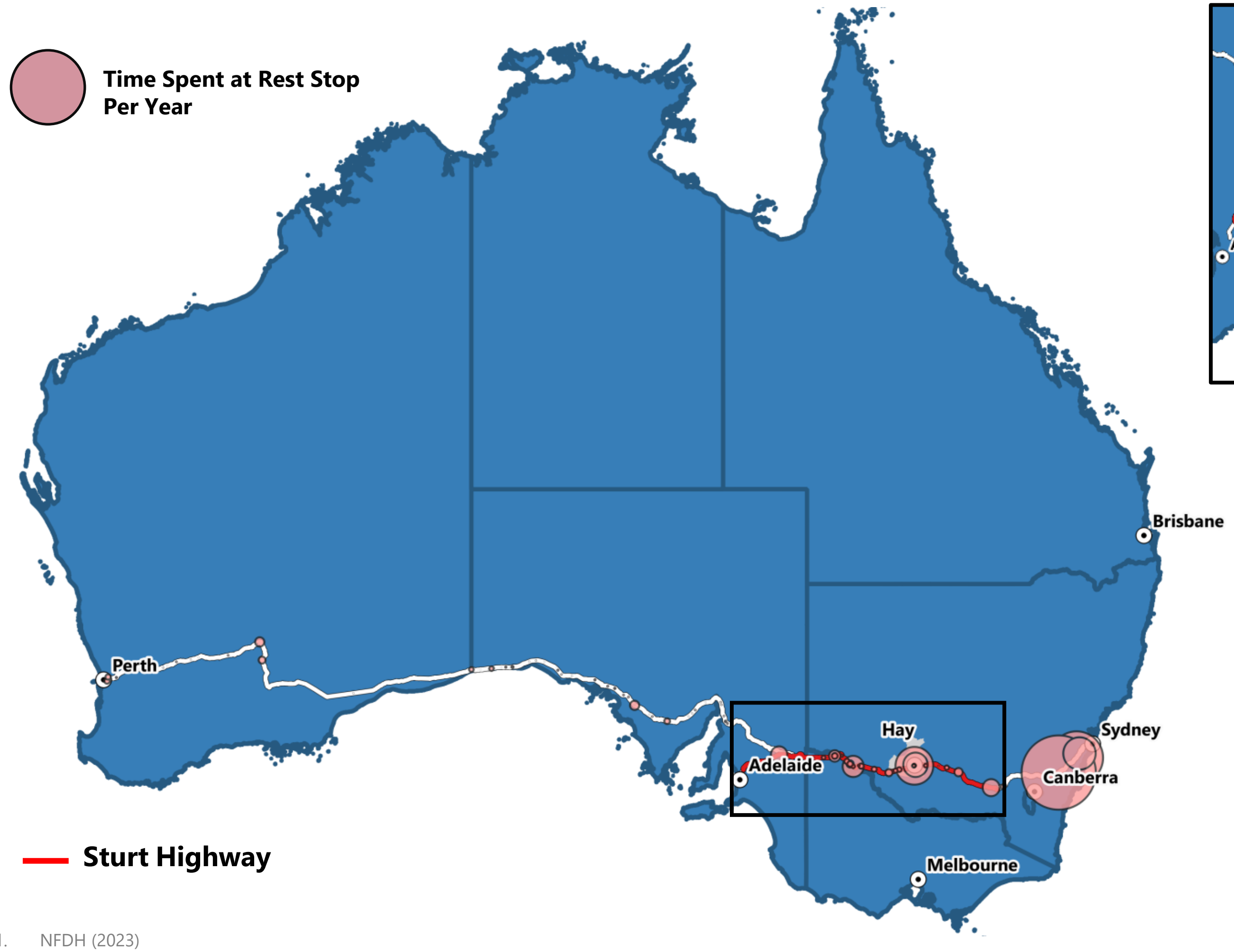


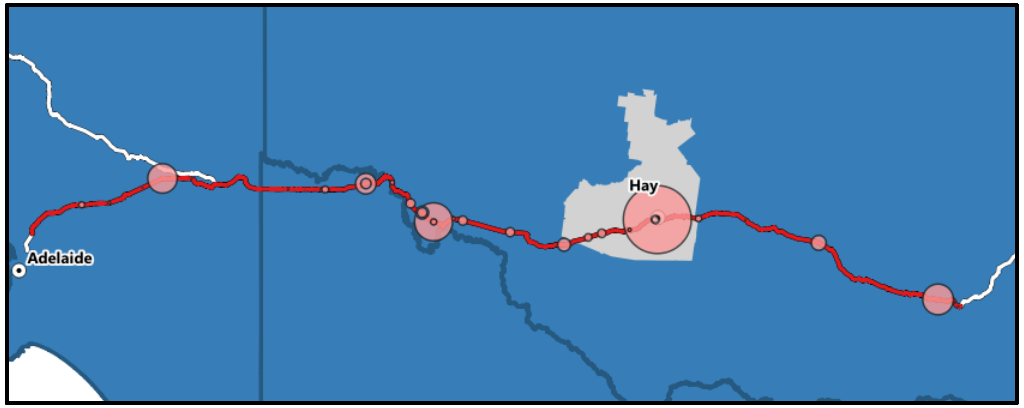
- Trucks originating in Sydney and traversing the East-to-West Corridor will pass through Hay Shire on the Sturt Highway.
- The Sydney-to-Adelaide route is ~1,400 km drive and takes approximately 15 hours to complete. Sydney-to-Perth is a ~4,100 km drive and takes approximately 41 hours to complete.
- Long haul trucks drivers typically drive between 8 to 12 hours a day, and Hay strategically sits as a rest stop between Sydney-to-Adelaide Route and Sydney-to-Perth Route.

1. Google Maps

East to West Corridor – Major Rest Stops for Heavy Vehicles

Data indicates that Hay is one of the most utilized rest stops on the Sturt Highway, with the Sydney-to-Adelaide route experiencing a significantly higher volume of traffic than Sydney-to-Perth.





- Data collated by NFDH has been visualised to highlight major rest stops by heavy vehicles along the Sydney-to-Adelaide/Perth Freight Route.
- Based on the data[1], Hay see's ~18,000 stops per year with a median rest time of approximately ~20 minutes, making it one of the most utilized rest stops on the Sturt Highway, and subsequently, the Sydney-to-Adelaide/Perth Freight Route.
- It is of note that duration of rest stops lean heavily towards the east coast, and indicates that the Sydney-to-Adelaide route has a significantly higher volume of traffic compared to the Sydney-to-Perth.

1. NFDH (2023)

Australian heavy vehicle fleet

Gross vehicle mass (GVM):
Maximum permissible weight of a vehicle when fully loaded

Gross combination mass (GCM):
Maximum loaded weight of the towing vehicle and any trailer(s) being towed.

The Australian Bureau of Statistics (ABS) defines the various vehicles classified within the Australian heavy vehicle fleet, of which 61% are heavy rigid vehicles.

Heavy Rigid

Motor vehicles of **GVM greater than 4.5 tonnes**, constructed with a load carrying area. Included are normal rigid trucks with a tow bar, draw bar or other non-articulated coupling on the rear of the vehicle.

Articulated Trucks

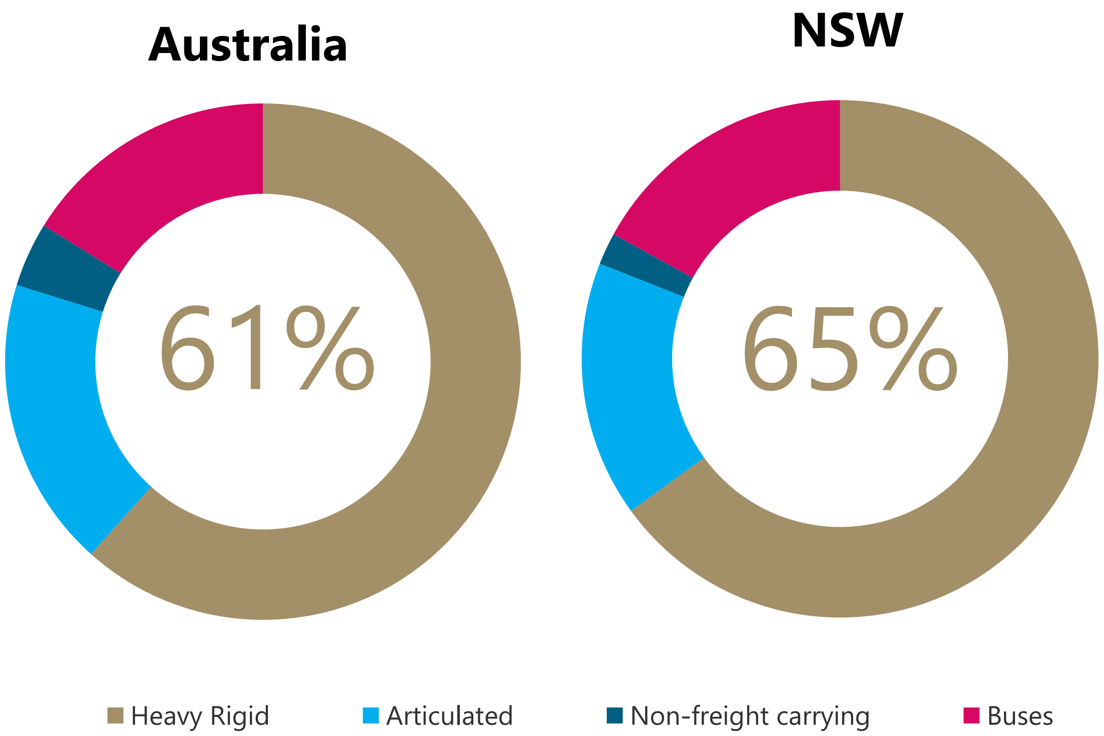
Motor vehicles constructed primarily for load carrying, consisting of a prime mover having no significant load carrying area, but with a **turntable device which can be linked to one or more trailers**.

Non-freight carrying vehicles

Specialist motor vehicles or motor vehicles fitted with special purpose equipment, and having little or no goods carrying capacity (e.g. ambulances, cherry pickers, fire trucks, tow trucks and tractors).

Buses

Motor vehicles constructed for the carriage of passengers. Included are all motor vehicles with 10 or more seats, including the driver's seat.



Heavy transport vehicles - Hay Shire Council

80% of heavy transport vehicles in NSW are heavy rigid vehicles, higher than Australia's total of 77%.

From the ABS' definitions of the Australian heavy vehicle fleet, only the **heavy rigid vehicles** and **articulated trucks** meet the specifications required for the Hay Shire Council's business case. These two vehicle types will hereby be referenced to as **'heavy transport vehicles'.**

Common trends of each vehicle include:

- Heavy rigid vehicles have a relatively even vehicle GVM distribution, varying $^{+}/_{-}$ 13% between weight classifications
- Articulated trucks predominantly have a GCM of 60-100t (53%), followed by 40-60t (34%)
- Articulated trucks with a GCM<40t comprise <5% of the vehicle fleet.

Comparison of the heavy transport vehicles shows:

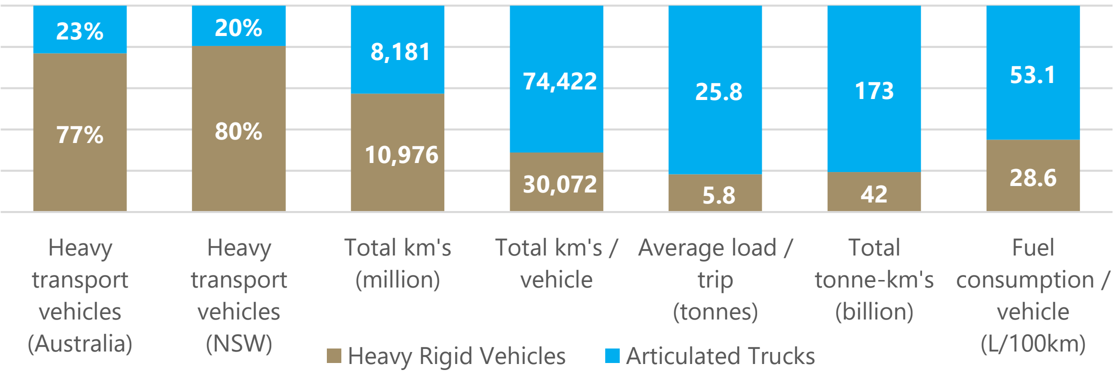
- Heavy rigid vehicles account for 80% of the NSW heavy transport market, higher than the national total of 77%
- Articulated trucks complete more than double the kilometres per vehicle than heavy rigid vehicles, however due to the large quantity of heavy rigid vehicles operating, the overall total kilometres is similar
- Articulated trucks have nearly doubled the fuel economy of heavy rigid trucks primarily due to the ~4.5x more load per trip. This is supported by the total tonne-km's of articulated trucks which is ~4x larger than that of heavy rigid vehicles.

Heavy rigid vehicles

GVM (t)	Vehicles	
Over 4.5 to 8	80,663	22%
Over 8 to 12	97,630	27%
Over 12 to 20	70,275	19%
Greater than 20	116,421	32%
-	-	-
Total	364,989	

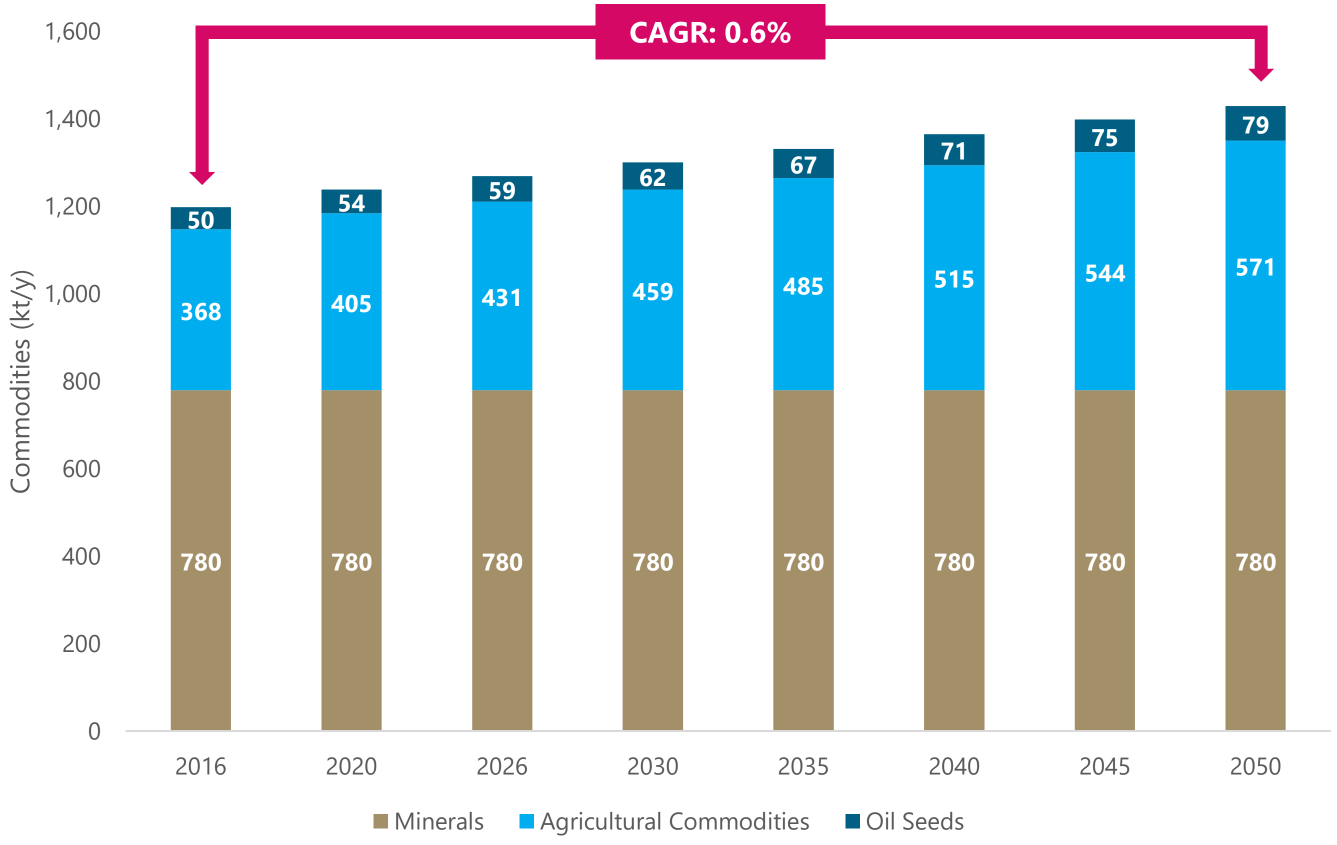
Articulated trucks

GCM (t)	Vehicles	
Over 3 to 20	1,143	1%
Over 20 to 40	4,130	4%
Over 40 to 60	37,076	34%
Over 60 to 100	57,802	53%
Greater than 100	9,776	9%
Total	109,927	



Sturt Highway – Commodity Freight Volume Forecast

Total commodities transported through Hay Shire are expected to increase at a Compound Annual Growth Rate (CAGR) of ~0.6% p.a. through to 2050.

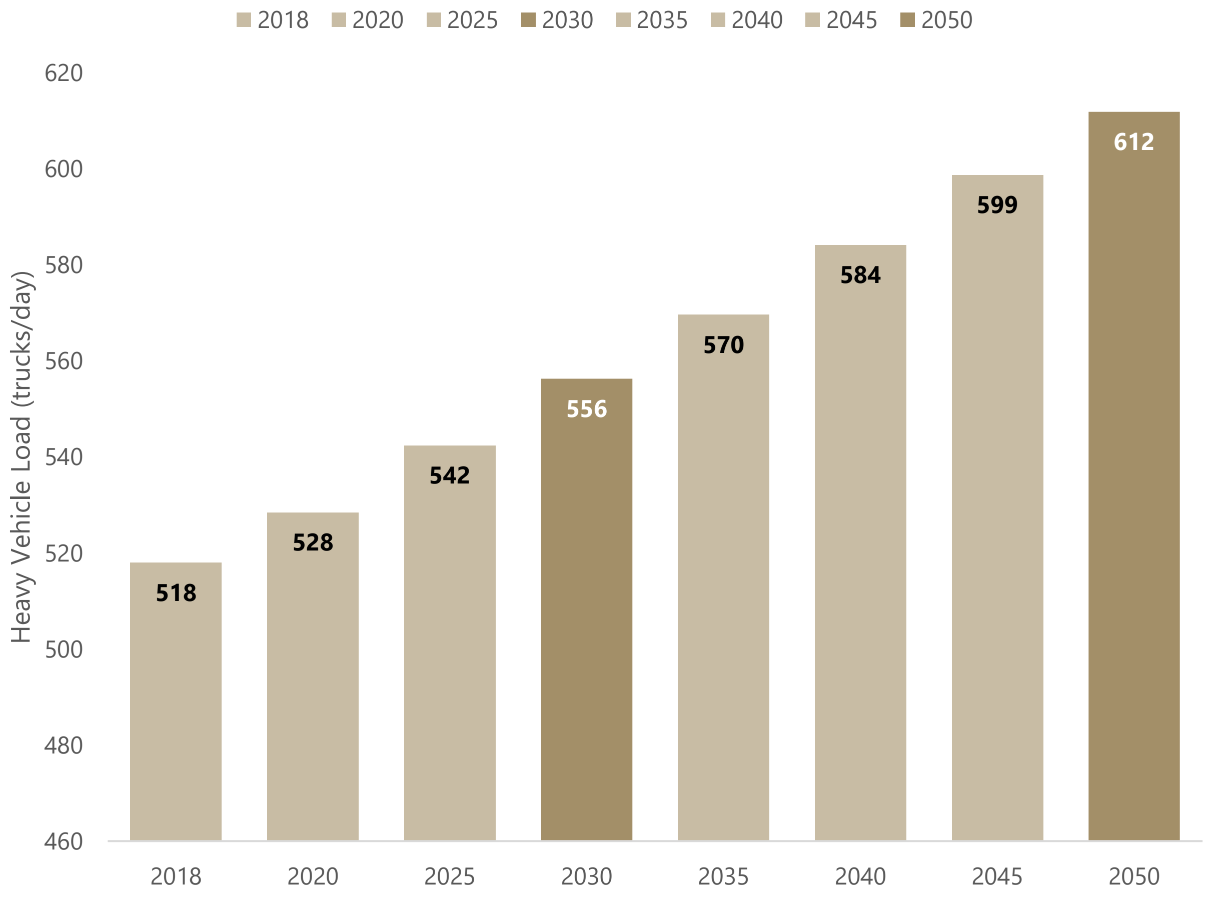


- Total freight through Lower Murray (Hay) in 2016 was estimated at 1,198 kt/y inclusive of:
  - 780 kt/y of Minerals;
  - 368 kt/y of Agricultural Commodities, and;
  - 50 kt/y of Oil Seeds.
- Total freight through Lower Murray (Hay) in 2050 is forecasted to be 1,430 kt/y inclusive of:
  - 780 kt/y of Minerals;
  - 571 kt/y of Agricultural Commodities, and;
  - 79 kt/y of Oil Seeds.
- As reported by TfNSW in their Commodity Demand Forecasts, no growth is expected for minerals load as it was considered that there are insufficient number of mines in NSW to respond to market demand signals.
- Between 2016 and 2050, the increase in annual freight load represents a CAGR of ~0.6% p.a.

1. TfNSW (2023)

Sturt Highway – Truck Load Forecast

Applying the 0.6% CAGR, the total Heavy Vehicle Load is estimated to be 556 trucks/day in 2030 along the Sturt Highway.

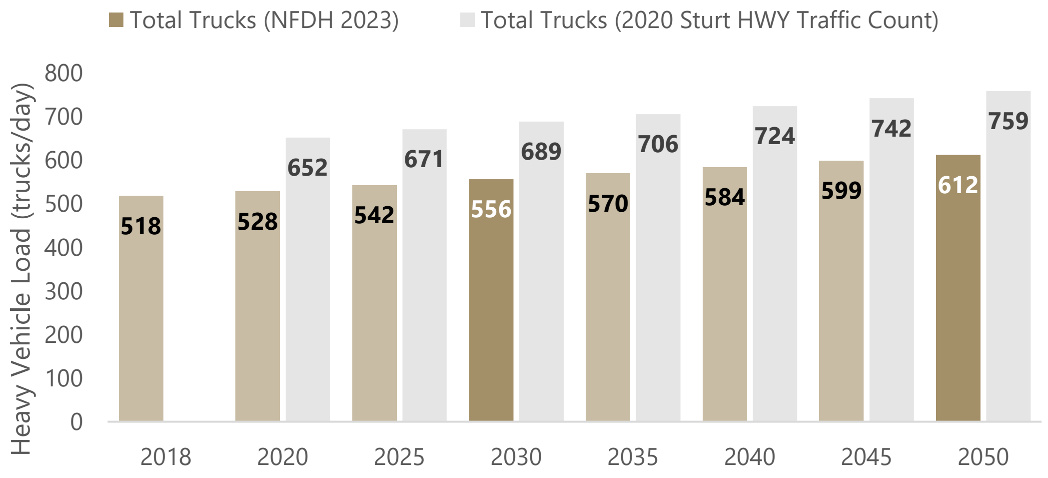


- Total Heavy Load was estimated to be 518 trucks/day on the Sturt Highway in 2018.
- Applying a 0.6% CAGR, the forecasted Heavy Vehicle Load is 556 trucks/day in 2030 and 612 trucks/day in 2050.
- The forecasted heavy vehicle load is only for Sturt Highway. The total Heavy Vehicle Load in Hay would be higher when factoring in the Cobb and Mid-Western Highway.

1. NFDH (2023)

Sturt Highway – Truck Load Forecast (updated data)

Despite an increase in expected truck load, updated data from a more recent (2020) traffic count is not expected materially change the outcomes of the study using the older data (2018).



- Updated data from a traffic count for heavy vehicles passing through Hay along the Sturt Highway in 2020 became available after completion of the study
- This was used to forecast the expected truck volumes through to 2050 using the same CAGR and approach as the initial 2018 dataset sourced from (NFDH)
- An assessment of the impact of the updated data was undertaken, concluding that due to the capital-intensive nature of an HRS investment, it is not expected that the comparatively higher demand that is forecast based on the more recent 2020 data will materially change the outcomes of the study.
- Comparison of the 2 datasets is provided in the table on the right:

Description	2018 NFDH Data		2020 Traffic Count Data	
	2030	2050	2030	2050
Expected Number of trucks per day	556	612	689	759
FCEV Market Participation Rate (%)	2%	43%	2%	43%
Expected Number of FECV trucks per day	11	262	13	326
Market Capture assumption (%)	100%	33%	100%	33%
Number of FCEV trucks based on Market Capture	11	87	13	107
Average Expected Refuelling Requirements per truck	54.5 kgs H2	65.5 kgs H2	54.5 kgs H2	65.5 kgs H2
Average Expected HRS Refuelling Capacity based on demand	~0.6tpd	~5.7tpd	~0.7tpd	~7tpd
HRS Design Configuration Required to Meet Demand	Medium (~1tpd)	2x Extra-large (2 x ~3tpd)	Medium (~1tpd)	1x Medium (~1tpd) + 2x Extra-large (2 x ~3tpd)

1. NFDH (2023)

Market Participation – FCEV Heavy Line Haul Trucks

By 2050, 43% of total heavy line haul trucks are expected to be Fuel Cell Electric Vehicles (FCEV).

Market Participation

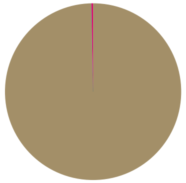
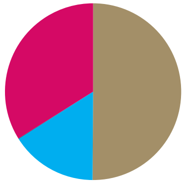
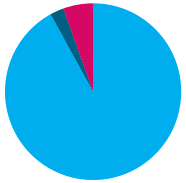
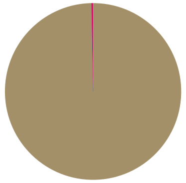
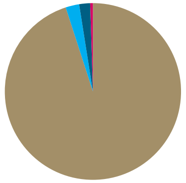
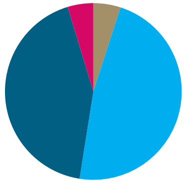
	2030			2050		
Scenario	HR[1]	BaU[2]	HS[3]	HR	BaU	HS
Starting Point		**100%**			**100%**	
Remaining fossil fuels		95%			5%	
Low carbon technologies		**5%**			**95%**	
Hydrogen	1.0%	**2.0%**	2.5%	14.3%	**42.8%**	61.8%
Battery electric	3.5%	2.5%	2.0%	76.0%	47.5%	28.5%
Other batteries	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Electric trolley systems	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Biomass based fuels	0.5%	0.5%	0.5%	4.8%	4.8%	4.8%
Nuclear	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

- Advisian completed *The Australian Hydrogen Market Study*[1] for CEFC analysing various sectors in relation to hydrogen adoption.
- The report indicates that the Participation rate for FCEV line haul trucks is expected to be 2% in 2030 and 43% in 2050 in the medium range.
- **In 2030,** market will be on the early stages of development with companies running trials and just some very early adopters completing the change to low carbon options, which in this case is likely to be a mix of hydrogen fuel cells and electric batteries.
- **In 2050,** market is expected to be mature and dominated by low carbon options. Unless there are increased safety concerns with hydrogen, it is expected that it can secure a reasonable share of the market.

1. Hydrogen Restrictive
2. Business as Usual
3. Hydrogen Supportive
4. https://www.cefc.com.au/insights/market-reports/the-australian-hydrogen-market-study/

Australian vehicle composition – Opportunity landscape[1,2]

The heavy vehicle FCEV market share is set to increase by more than 20x from 2030 to 2050.

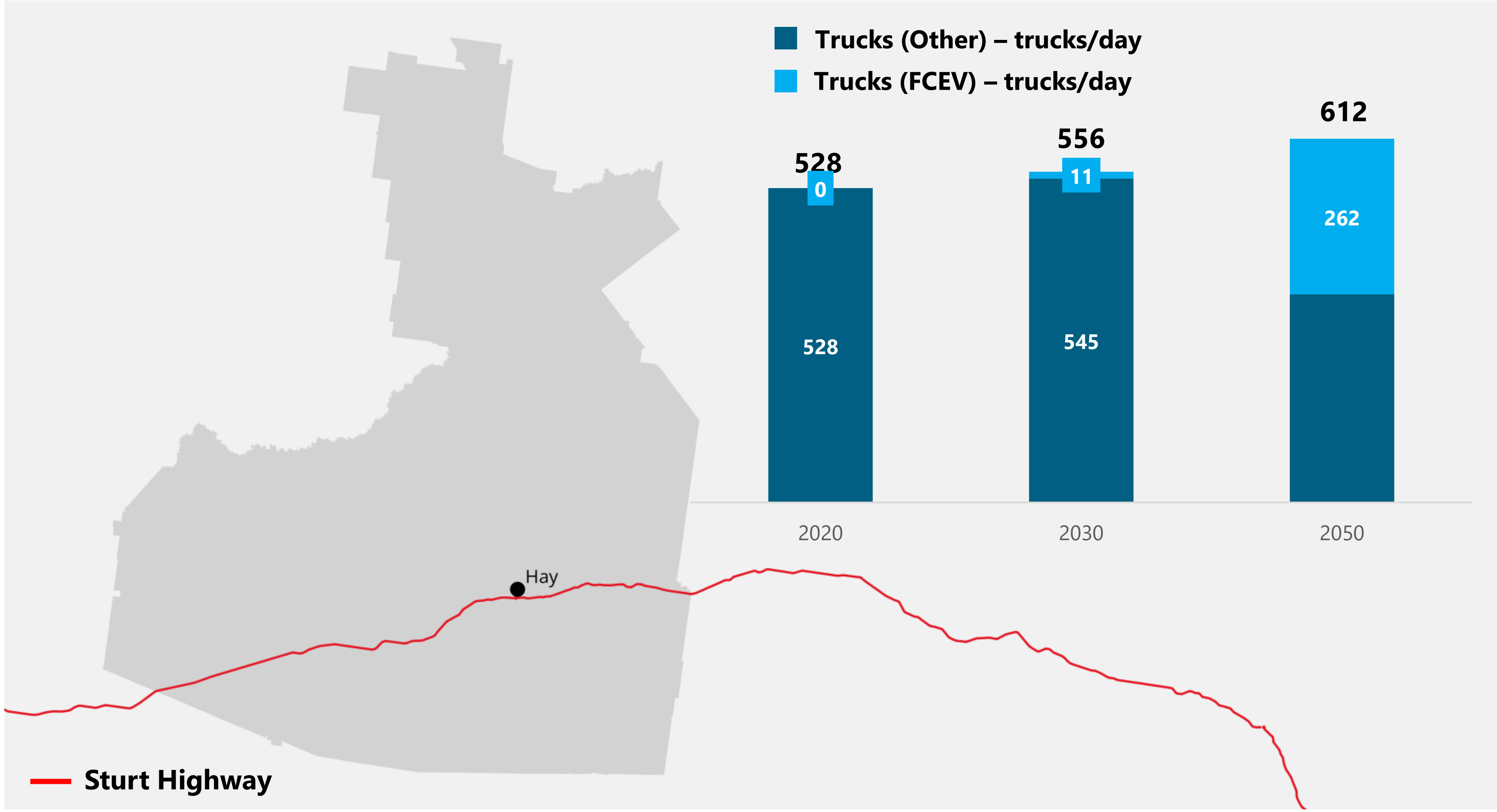
Year	2023				2030				2050			
Vehicle type	**ICE**	**BEV**	**FCEV**	**Other[3]**	**ICE**	**BEV**	**FCEV**	**Other[3]**	**ICE**	**BEV**	**FCEV**	**Other[3]**
Overall Australian vehicles												
Market share	97%	0.4%	<0.01%	2.6%	50.1%	15.9%	<0.1%	33.9%	0.0%	92.0%	2.5%	5.5%
												
	Significant majority ICE (97%)				Development of hybrid technology and BEV reduces ICE market share				To meet Australia's Net Zero 2050 targets, planned production bans on ICE by 2040 and rapid deployment of BEVs			
Australian heavy vehicle fleet												
Market share	99.7%	<0.02%		0.3%	95%	2.5%	2%	0.5%	5%	47.5%	42.8%	4.7%
												
	Significant majority ICE (99.7%)				Heavy vehicle FCEVs established (2%)				Heavy vehicle market dominated by BEVs (47.5%) and FCEVs (42.8%)			

ICE
BEV
FCEV
Other

1. Includes heavy rigid and articulated trucks that meet the heavy duty FCAI classification requirements
2. ABS (2023)
3. 'Other' includes Dual Fuel, HEVs, not specified vehicles and some biomass based fuels

Sturt Highway – FCEV Heavy Vehicle Forecast

By 2050, 262 FCEV Heavy Vehicles are forecast to be on the Sturt Highway on a per day basis.



- A 2% and 43% Participation rate was applied in 2030 and 2050, respectively
- In 2030, a forecasted ~11 trucks/day will be FCEV out of the total 556 trucks/day on the Sturt Highway.
- In 2050, a forecasted ~262 trucks/day will be FCEV out of the total 612 trucks/day on the Sturt Highway.

OEM overview

Hyzon and HDrive provide the greatest OEM opportunities for FCET supply to the Hay Shire region

	HYZON	HYUNDAI	HDrive	NIKOLA
Relevant vehicle type and model	i. HRV – HYHD8-110 ii. HRV – HYMAX 450 6x4 (24t GCM) iii. AT – HYMAX 450 6x4 (46t GCM) iv. AT – HYMAX 450 6x4 (70t GCM)	i. HRV – Xcient FC 6x2 ii. AT – Xcient Tractor 6x4	i. HRV – T23-H220 ii. AT – HP70-440	i. AT – TRE FCEV
FCEVs summary	Wide range of FCET's that can be supplied to the Australian FCET market.	Xcient is widely distributed globally, maximum speed of 85 km/h for all FCET not suitable for Australian roads although.	Wide range of FCET's that can be supplied to the Australian FCET market.	Established AT that services the North American and European FCET market.
Company overview	FCEV supplier becoming established in Australia. Wide range of vehicles that are suitable for future hydrogen mobility projects.	Established OEM, reputable company and supplier of FCEV globally.	Australian based, parent company is BLK Auto, Pure Hydrogen has a 60% controlling share of the company.	OEM is located globally, including in Australia. Primarily supplying ICE trucks to major transport companies, has diversified with some BETs and FCETs.
Australian impact	Production in Australia, global presence. Port Kembla refuelling facility utilising two Hymax-450 prime mover trucks.	Offices and HRS pilot in operation for passenger vehicles (20 x Hyundai Nexo's at ActewAGL HRS in Canberra).	Based in Australia, signed a MoU with New Wisdom Motors to supply 12,000 FCET to HDrive by 2028, but haven't allocated all vehicles to customers yet.	FCETs not established in Australia, with no plans to expand into the Australian FCET market either.
HSC suitability	Wide offering of FCET's, reputable company with good partnership and supply opportunities.	FCET's not suitable for Australian roads, not suitable for HSC opportunity.	Wide offering of FCET's, reputable company, good partnership and supply opportunities.	Like-for-like displacement of ICE AT if Nikola does expand their FCETs to the Australian market.
Recommendation	Depending on cost, engage Hyzon as an OEM supplier of FCET's.	Do not engage, FCET's not suitable for Australian roads.	Depending on cost, engage HDrive as an OEM supplier of FCET's.	Limited opportunities available given no indication of expanding into Australian FCET market.

**Hino and Kenworth FCEVs have been omitted due to still being under development and not apart of the current heavy vehicle market*

Current state of Heavy Vehicle FCEV technology

FCEV OEMs typically have a presence in Australia, but besides Hyzon and HDrive, are not supplying FCEVs to the Australian market

Vehicle Type	Vehicle	Performance	Cost		Reliability	Established in Australia		Future improvements
Criteria	-	Max speed compatible with local speed limits (100km/h)	Will the TCO of FCETs likely be comparable or better to **ICE trucks** by 2030?	Will the TCO of FCETs likely be comparable or better than **BETs** by 2030?	Proven vehicle performance	OEM presence within Australia	FCEV supply established in Australia	Is there potential for future advancements and improvements?
Heavy Rigid Vehicles (HRV)	Hyzon HYHD8-110	✓	✗	✓	✓	✓	✓	✓
	Hyzon HYMAX 450 6x4 (24t GCM)	✓	✗	✓	✓	✓	✓	✓
	Hyundai Xcient FC 6x2	✗	✗	✓	✓	✓	✗	✓
	HDrive T23-H220	✓	✗	✓	✓	✓	✓	✓
Articulated Trucks (AT)	Hyzon HYMAX 450 6x4 (46t GCM)	✓	✗	✓	✓	✓	✓	✓
	Hyzon HYMAX 450 6x4 (70t GCM)	✓	✗	✓	✓	✓	✓	✓
	Nikola TRE FCEV	✓	✗	✓	✓	✓	✗	✓
	Hyundai Xcient Tractor 6x4	✗	✗	✓	✓	✓	✗	✓
	HDrive HP70-440	✓	✗	✓	✓	✓	✓	✓

**Hino and Kenworth FCEVs have been omitted due to still being under development and not apart of the current heavy vehicle market*

Current heavy rigid market

Heavy rigid FCEVs are predominantly available in North America and Europe, Hyzon and HDrive are the only OEMs currently supplying heavy rigid FCEVs to Australia.

Type	Primary OEM	Model	Status	Production Year	Pressure class (bar)	Range (km)	H2 Capacity (kg)	Refuelling time (min)	Maximum speed (kmph)	GVM (t)	GCM (t)	Established Markets	Image	Comments
FCEV	Hyzon	HYHD8-110	Operating	2021	350	560	50	15	106	-	24	North America, **Australia**		110kW FC, established in Australia, 200kW underdevelopment
		HYMAX 450 6x4	Operating	2021	350	400	30	15	106	-	24	Europe**, Australia**, Asia		Available as articulated trucks with GCM of 46 and 70 tonnes
	Hyundai	Xcient FC 6x2	Operating	2020	350	400	31	8-20*	**85**	27	42	North America, Europe		Limited speed
	HDrive	T23-H220	Operating	2023	700	≥450/ 850	70	15-20	100	-	23	**Australia**, China		Multiple models available
	Hino / Toyota	Hino XL FCEV	**Under development**	-	700	600	70	<20	-	25	30	North America		Minimal details available

Type	Primary OEM	Model	Status	Production Year	Battery capacity (kWh)	Range (km)	AC recharge time (hours)	DC recharge time (hours)	Maximum speed (kmph)	GVM (t)	GCM (t)	Established Markets	Image	Comments
BEV	Volvo	FH Electric 6x2	Operating	2022	540	300	9.5	2.5	"Highway capable"	26	-	Europe, North America		Multiple models available for various uses.

Type	-	-	Status	Production Year	-	Range (km)	Fuel Economy (L/100km)	Refuelling time (min)	Maximum speed (kmph)	GVM (t)	GCM (t)	Established Markets	Image	Comments
ICE	ABS Australia average	-	Operating	All	-	1,500	28.6	~10	"Highway capable"	4.5-30	-	Australia	-	Based on averages for all vehicles in this classification

**Dependant on ambient temperature*

Current articulated truck market

Articulated truck FCEVs are currently being developed for an Australian market by Hdrive.

Type	Primary OEM	Model	Status	Production Year	Pressure class (bar)	Range (km)	H2 Capacity (kg)	Refuelling time (min)	Maximum speed (kmph)	GVM (t)	GCM (t)	Established Markets	Image	Comments
FCEV	Hyzon	HYMAX 450 6x4	Operating	2021	350	680	50	15	106	-	**46**	Europe, **Australia**, Asia		Also available as a heavy rigid 24t GCM vehicle
			Operating	2021	350	600	60	15	106	-	**70**			
	Nikola	TRE FCEV	Operating	2023	700	800	70	< 20	112	23.6	37.2	North America, Europe		High pressure and range FCEV
	Hyundai	Xcient Tractor 6x4	Operating	2023	700	725	68.6	8-20*	**85**	-	37.2	North America		Limited speed, higher pressure vehicle
	HDrive	HP70-440	Operating	2023	700	≥500	70	15-20	100	-	68	China, **Australia**		Available for 18, 42 and 49 t GCM. Australian company, vehicles manufactured in China
	Kenworth / Toyota	T680 FCEV	**Under development**	2024	700	725	58.8	15	112	-	37.2	North America		Client production 2024, scaled in 2025 for North America

Type	Primary OEM	Model	Status	Production Year	Battery capacity (kWh)	Range (km)	AC recharge time (hrs)	DC recharge time (hrs)	Maximum speed (kmph)	GVM (t)	GCM (t)	Established Markets	Image	Comments
BEV	Volvo	FH Electric 6x4	Operating	2022	540	300	9.5	2.5	"Highway capable"	26	44	Europe, North America		Completing container tests in Sweden for High Capacity Transports (HCT) for **74 t GCM**

Type	-	-	Status	Production Year	-	Range (km)	Fuel Economy (L/100km)	Refuelling time (min)	Maximum speed (kmph)	GVM (t)	GCM (t)	Established Markets	Image	Comments
ICE	ABS Australia average	-	Operating	All	-	1000	53.1	~10	"Highway capable"	-	40-100**	Australia	-	Based on averages for all vehicles in this classification

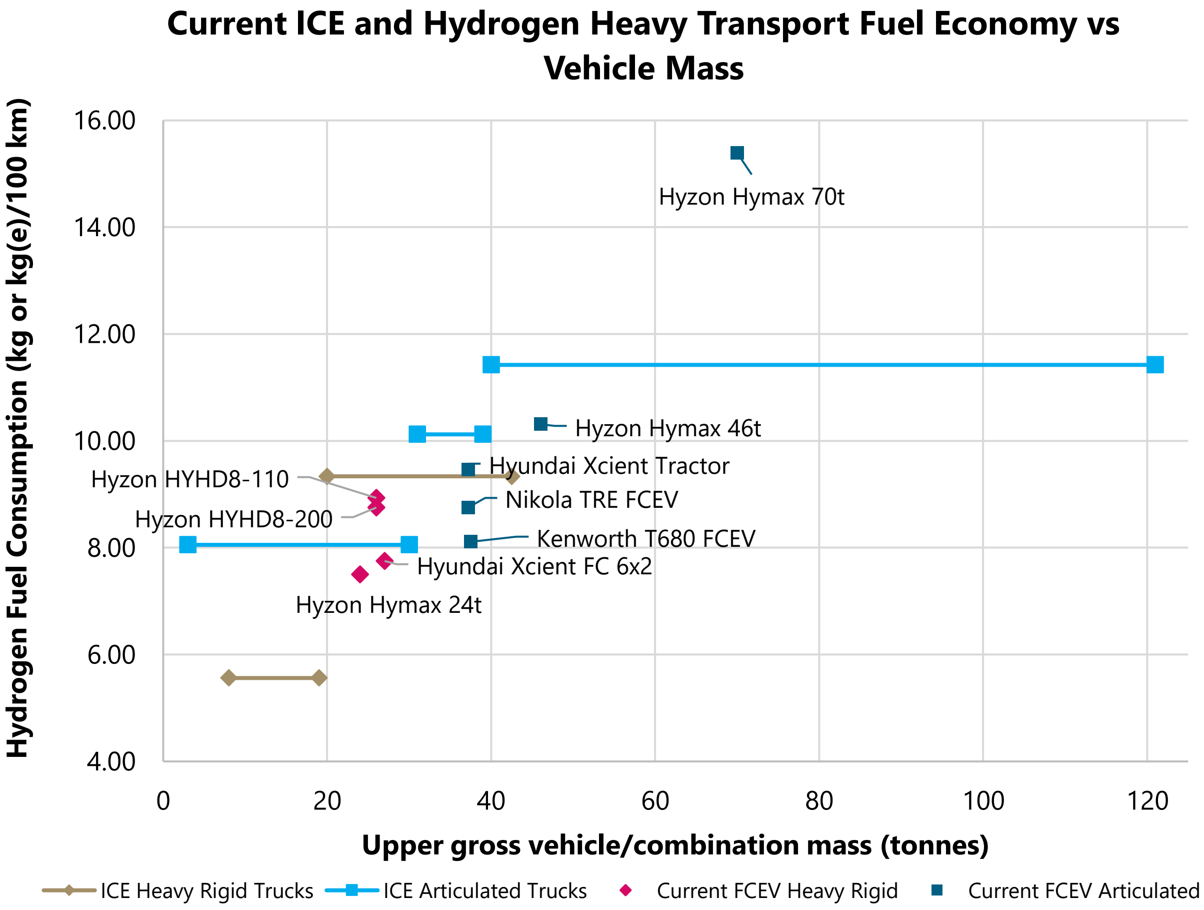
**Dependant on ambient temperature*
***Majority (85%) of market GCM*

Current heavy transport FCEV Fuel Economy

FCEVs alternatives are currently at the lower end of the Australian heavy transport market.

Analysis of the overall fuel economy of the Australian heavy transport market shows:

- Increased vehicle weight (GVM/GCM) leads to an increase in average fuel consumption for current ICE vehicles
  - Heavy rigid ranges from 17.6 L/100 km for GVM 4.5 – 8t up to 43.8 L/100 km for trucks over 20t[1]
  - Articulated range from 37.8 L/100 km for GCM up to 30 t and 53.6 for vehicles over 40t. The majority of articulated trucks have a GCM of >40t
- Most Current FCEVs are in the 20 – 30t configurations with fuel consumption of 7.5 – 9 kg/100 km in this range
- Above 40t there are currently limited options for FCEVS:
  - Hyzon is currently the only supplier within this segment, with Hymax available in 46 and 70t configurations
  - The fuel economy of these vehicles is quoted at 10.3 kg/100 km and 15.4 respectively, averaging ~13 kg/100km



1. ABS Stats
2. ICE average fuel consumption converted to equivalent Hydrogen using maximum efficiencies of ICE = 47% and FCEV = 60%, https://www.energy.gov/sites/default/files/2023-03/h2iqhour-02222023.pdf

Future expected heavy transport FCEV market

The heavy transport FCEV market is set to exponentially increase in uptake due to expected improvements in vehicle capacities.

Currently Heavy transport FCEVs are still in the initial stages of market rollout and adoption, both globally and particularly for the Australian truck industry. By 2030, the market Participation of FCEVs for heavy vehicles is expected to increase to 2% in Australia. Currently there are:

- Limited FCEV being made for the Australian market. Hyzon currently have heavy rigid trucks available to the Australian market.
- There are limited options for vehicles with a GCM > 40 t and these have a limited range ~400 km (dependent on towage and actual conditions)

Given the limited range of OEMs currently serving the Australian market, the **2030 forecast** is based on:

- Current average fuel consumption for Hydrogen vehicles on the market as any marked efficiency gains are unlikely to be realised in this timeline
- The maximum vehicle size is currently ~70t
- Fuel consumption for vehicles 4.5 to 30t averages 8.5 kg/100 km and 13 kg/100 for vehicles up to 70t

Technology improvements are forecast as demand and uptake of FCEVs increases, both in terms of efficiency, range covered and towing capacity. The **2050 forecast** includes:

- A 30%[1] improvement in fuel economy based on vehicles currently available (up to 70t) reducing fuel demand to ~6 kg/100 km for vehicles <30t and ~9 kg/100km for vehicles up to 70t
- OEMs will expand their offering to include the longer haul market, providing vehicles up to 100t. A conservative estimate has been made that these vehicles will consume approximately 13% more fuel than the 70t vehicles based on current ICE average fuel consumption data. Therefore, vehicles above 70t are forecast to consume ~15 kg/100 km

The HRS will be sized to meet the refuelling needs based on:

- Fuel consumption, vehicle range and number of vehicles served
- Provision of both 350/700 bar pressure range

Key Vehicle Parameters

Conditions	Current ICE		Current & Projected Specifications for Heavy Vehicle FCEVs					
	Current Market				2030		2050	
	Heavy Rigid	Articulated	Heavy Rigid	Articulated	Heavy Rigid	Articulated	Heavy Rigid	Articulated
Vehicle Size (GVM for HR/GCM for Articulated) (tonnes)	4.5 – 42.5	40 - 120	4.5 to ~27	40 - 70	4.5 – 27.5	Up to 70	4.5 – 40	Up to 100
Range (km)	1,500	1,000	400 - 800	400	400 - 800	400	400 - 1200	400 - 800
Average Hydrogen Fuel Consumption (kg(e)/100km or kg/100km)[2]	6.1	11.3	7.5 – 9	10.3 – 15.4	8.5	13	7.5	11.9
Expected H2 for Consumed for Range (kg)	91.5	113	35 – 70	45 – 65	35 – 70	55	35 - 85	50 - 105

1. https://theicct.org/wp-content/uploads/2022/07/fuel-cell-tractor-trailer-tech-fuel-1-jul22.pdf
2. ICE average fuel consumption converted to equivalent Hydrogen using maximum efficiencies of ICE = 47% and FCEV = 60%, https://www.energy.gov/sites/default/files/2023-03/h2iqhour-02222023.pdf

FCEV cost outlook

There are four main cost drivers associated to underlying economics of FCEVs.

Criteria	Description
Capital Cost	There are still high level of uncertainties on the varying capital costs of different types of FCEV. Given this is a nascent technology, it is expected as the volume of manufacturing increases over time, the capital costs would become cheaper. This, coupled with multiple state governments pushing to bring the cost of hydrogen down to 3$/kg would also provide an incentive for vehicle manufacturers to bring the overall capital cost of vehicles.
Fuel Cost	The expected cost reduction in fuel cost is dependent on the development technology in the green hydrogen supply chain, the rate at which projects and their volume scales up in addition to the efficiency of electrolysers. Government incentives would also assist in reducing total fuel cost.
Fuel Consumption	As technology progresses, research and development is expected to improve the overall fuel consumption efficiency of all types of vehicles, be it diesel, electric or fuel cell. Exact fuel consumption over time horizons is hard to predict for nascent technology like fuel cell, and will be dependent on the development of the drivetrain technology.
Vehicle Lifetime	FCEV and EVs could be used for longer, due to lesser rotating/moving parts compared to diesel vehicles. Hence, if these vehicles have a longer road lifetime then the residual value is improved which impacts the overall TCO.

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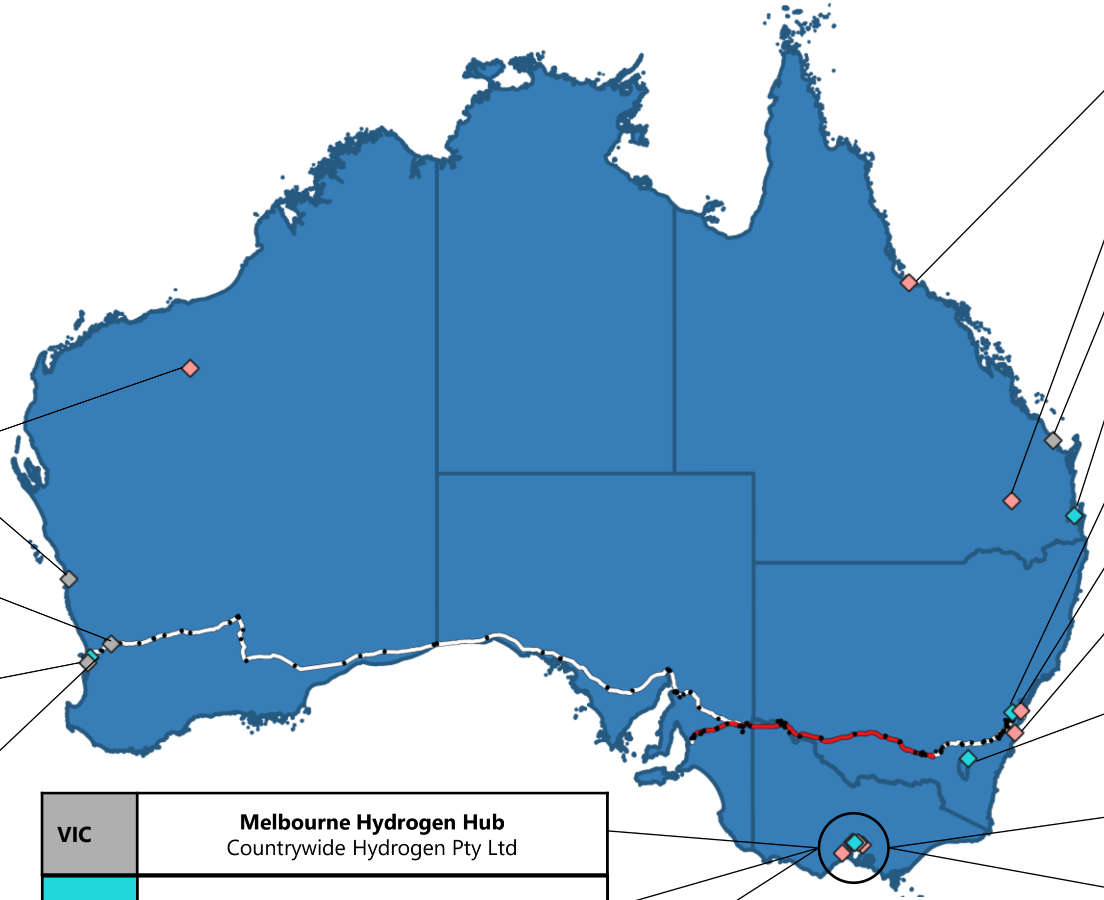
Fuel and Hydrogen Refuelling Stations (HRS)

A large portion of HRS's in development are in major cities on the East Coast.

- Existing Petrol Fuel Stations

Hydrogen Refuelling Stations

- Under Development
- In Execution
- In Operation



QLD	**Sun HQ HRS** Ark Energy
QLD	**Kogan Creek HRS** CS Energy
QLD	**Organic Waste to Green H2 HRS** Utilitas-ReCarbon
QLD	**BP service station** BOC

NSW	**Toyota Kemps Creek** *Mobile HRS for Forklifts*
NSW	**Hyundai Sydney HRS** Hyundai
NSW	**Port Kembla Hydrogen Facility** HDrive

ACT	**ActewAGL HRS** ACT gov./ActewAGL/Hyundai/Neoen

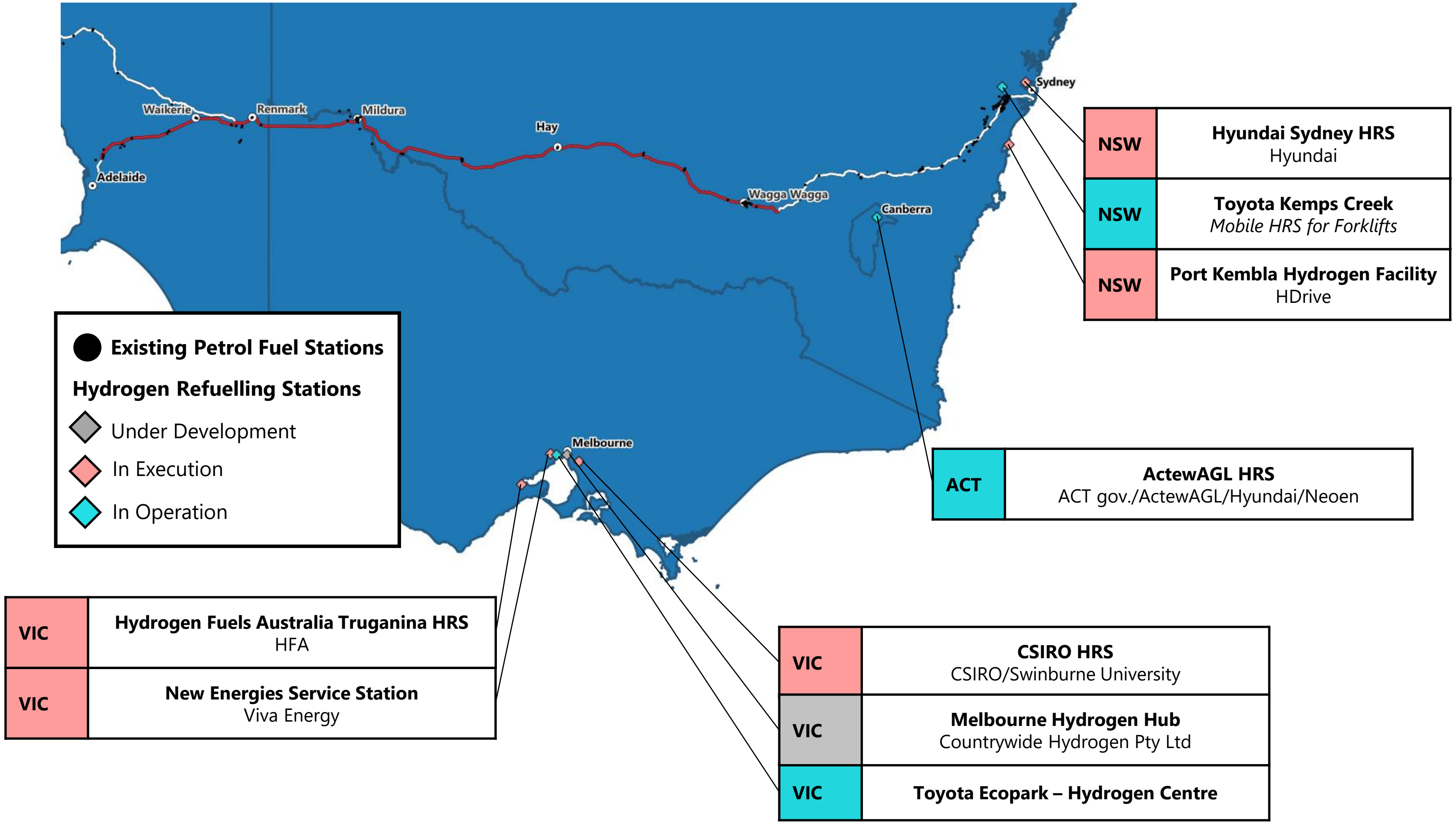
VIC	**Hydrogen Fuels Australia Truganina HRS** HFA
VIC	**New Energies Service Station** Viva Energy

WA	**Christmas Creek Renewable Hydrogen** Fortescue Metals Group
WA	**Arrowsmith Hydrogen project** Infinite Blue Energy
WA	**MEG-HP1** Infinite Green Energy
WA	**H2 Perth HRS** Woodside
WA	**ATCO Refuelling Station**

VIC	**Melbourne Hydrogen Hub** Countrywide Hydrogen Pty Ltd
VIC	**Toyota Ecopark – Hydrogen Centre**
VIC	**CSIRO HRS** CSIRO/Swinburne University

Potential Hydrogen Refuelling Stations (SYD – ADL)

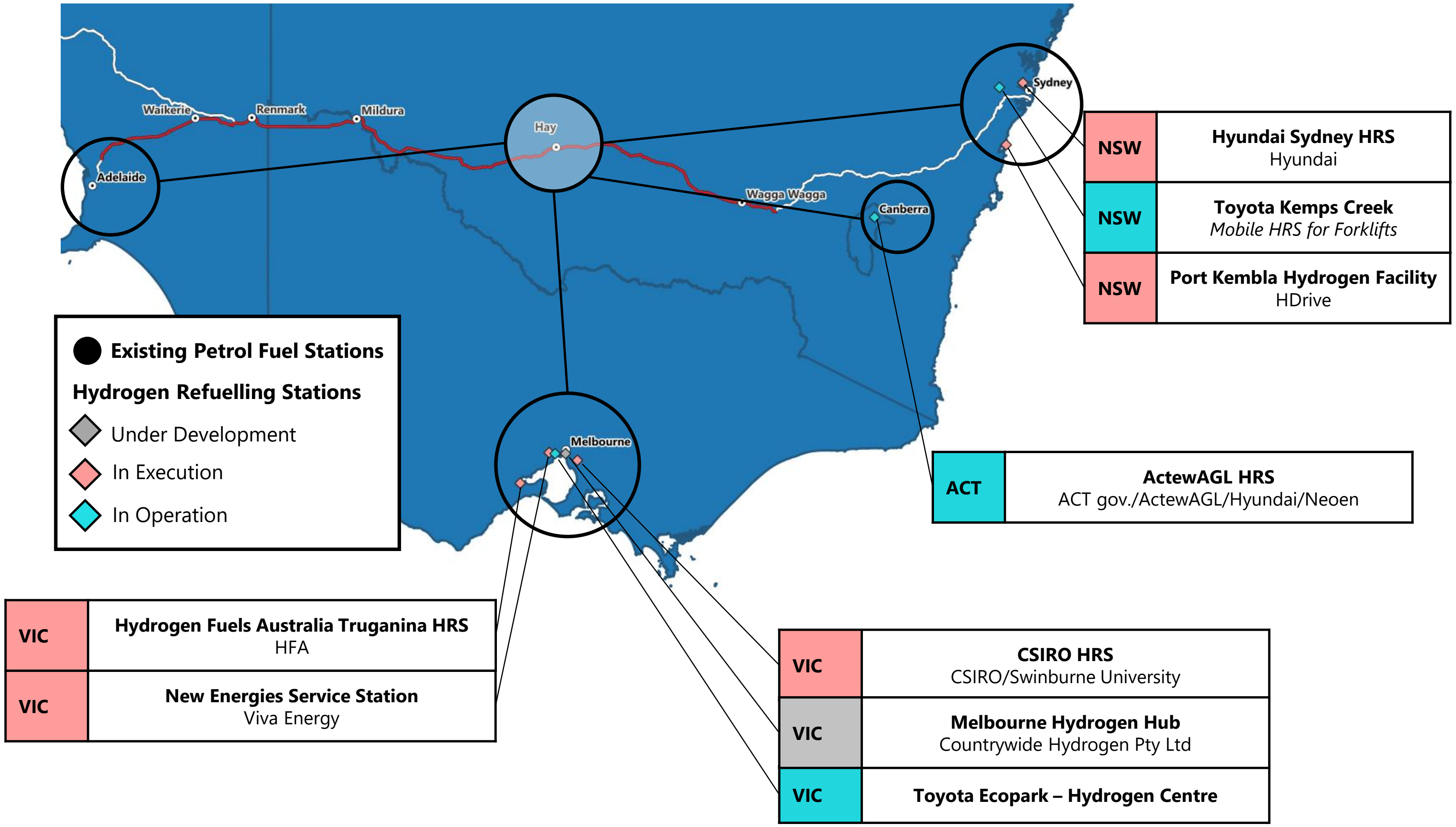
Hydrogen infrastructure for transportation can be integrated into the existing refuelling network.



- There is significant opportunity to leverage existing service stations to readily integrate FCEV's into the existing refuelling network.
- Currently, the Sturt Highway has at least one existing fuel stations at 80km intervals.
- The frequency of fuel stations is reflective of the population density, where the majority of existing fuel stations on the Sturt Highway are located in regional towns including Wagga Wagga, Hay, Mildura, & Renmark.
- Hay currently has three existing fuel stations primarily to service road freight and demands from local population.
- Ability to meet existing fuel demands from road freight within Hay will be dependent on the availability of renewable energy and water sources within the region.

Potential Hydrogen Refuelling Stations (SYD – ADL)

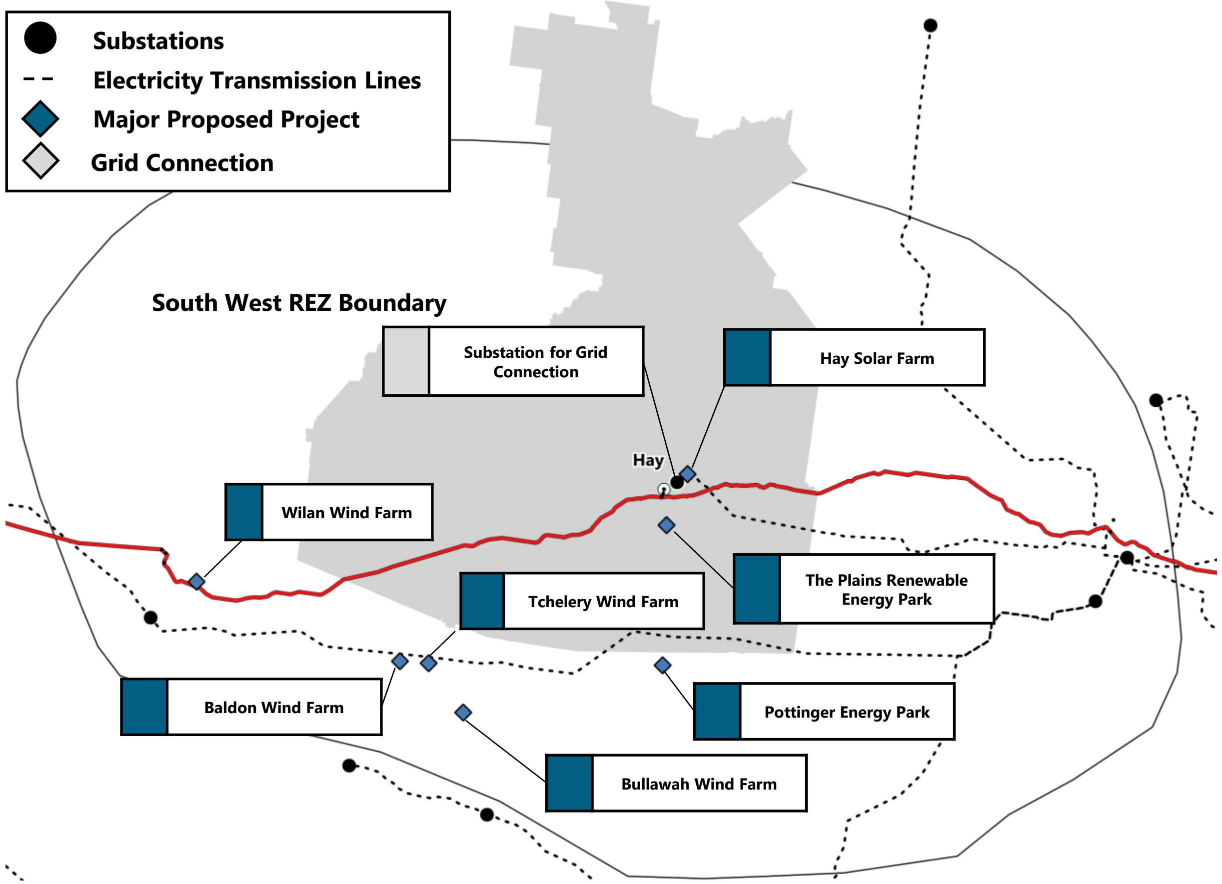
There are currently no HRS's in development that will service the Sydney to Adelaide Freight Route.



- Hydrogen infrastructure in transportation is still at an early stage, especially in relation to long-haul trucks.
- Of the existing developments for HRS's in NSW, only the Port Kembla Hydrogen Facility will be able to be utilised by trucks.
- Adelaide currently has no HRS's in development.
- For the Sydney to Adelaide Route, Hay is well placed to service as a rest and refuelling stop for FCEV Heavy Vehicles when a HRS in Adelaide comes online.
- Outside the Sydney to Adelaide route, developing a hydrogen hub in Hay can potentially leverage its strategic position to become a gateway for road freight travelling to Adelaide and Perth in the future.
- A hydrogen hub in Hay maybe able to attract other freight routes destined for South Australia (such as Melbourne-to-Adelaide), and by extension Western Australia (Melbourne-to-Perth).
- Increasing the number of refuelling stops on key freights routes between the major Eastern cities will be key to maturing Hydrogen infrastructure for transportation.

Major Renewable Projects within Hay Shire

Hay Shire sits within the South West Renewable Energy Zone (REZ) with multiple proposed renewable energy projects.



Source	Owner	Power Generation	Approval Stage
Hay Solar Farm	Overland Sun Farming Pty Ltd & Island Green Power UK	110 MW Solar Farm	Approved
The Plains Renewable Energy Park	Engie	500 MW Solar Farm 226 MW Wind Farm 400 MW BESS	EIS Preparation
Tchelery Wind Farm	Neoen	800MW Wind Farm	Scoping Study
Pottinger Energy Park	Someva Renewables	300 MW Solar Farm 750 MW Wind Farm 500 MW BESS	EIS Preparation
Bullawah Wind Farm	BayWa.r.e	1 GW Wind Farm 500 MW BESS	EIS Preparation
Baldon Wind Farm	Goldwind Australia & Lacour Energy	900 MW Wind Farm	EIS Preparation
Wilan Wind Farm	Kilara Energy	800 MW Wind Farm 200 MW BESS	EIS Preparation
Grid Connection			N/A

1. NSW Government Major Projects – Hay Shire LGA

Options Screening – Preferred Renewable Energy Source

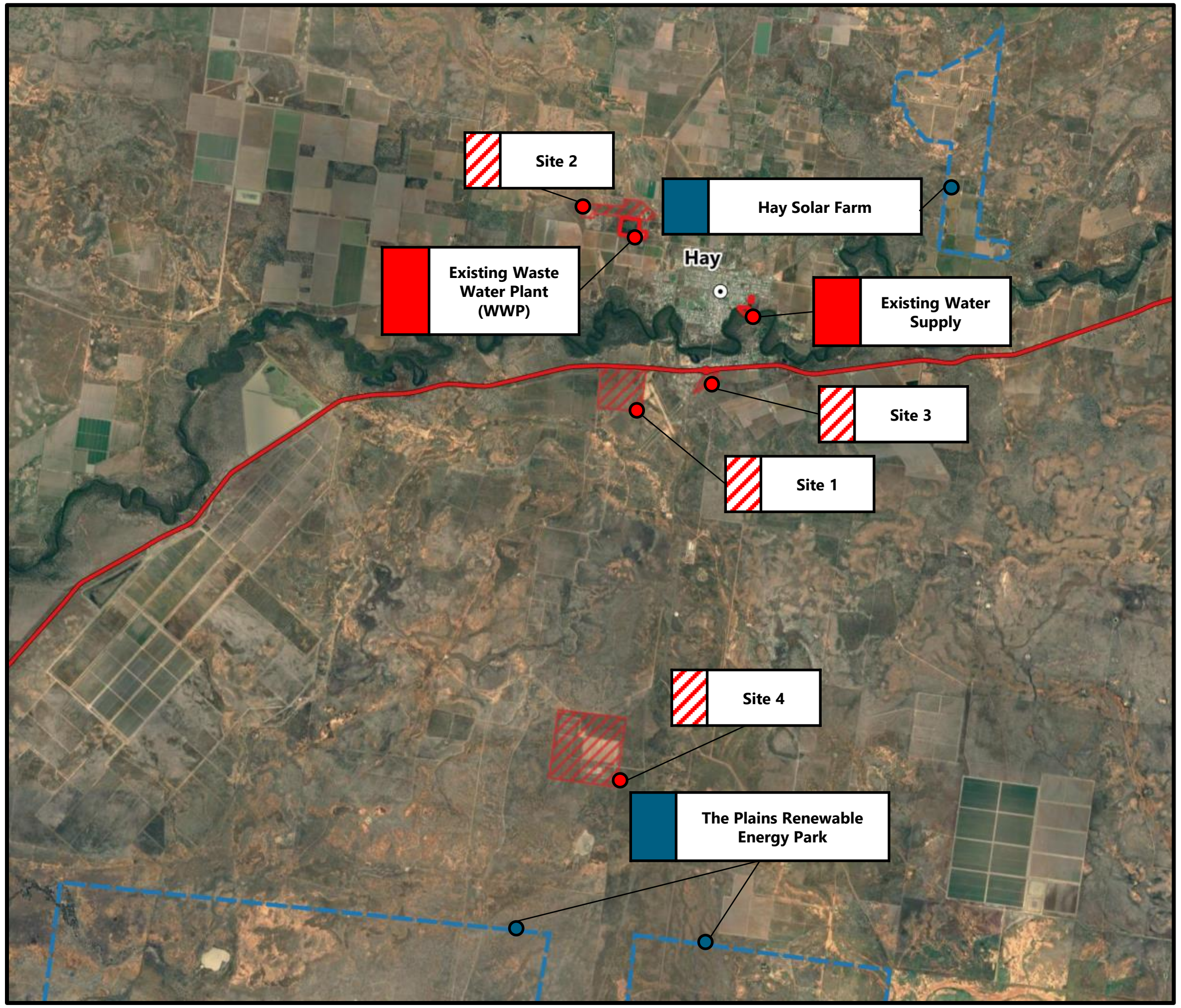
Stability of generation mix, proximity to Hay and reputation of the proponent make The Plains Renewable Energy Park the preferred renewable energy source option.

Local Energy Source Project	Energy Provider	Generation Mix & Capacity	Key Criteria					Priority
			Adequate Generation Capacity (>7.5MW)	Stable Generation Mix	100% Renewables	Proximity to Potential Sites (<20 km to Hay)	Reputable Provider (>$0.5bn/yr turnover)	
Hay Solar Farm	Island Power UK	110 MW Solar Farm	☑	☒	☑	☑	☒	X
The Plains Renewable Energy Park	Engie	500 MW Solar Farm 226 MW Wind Farm 400 MW BESS	☑	☑	☑	☑	☑	✓
Tchelery Wind Farm	Neoen	800MW Wind Farm	☑	☒	☑	☒	☑	X
Pottinger Energy Park	Someva Renewables	300 MW Solar Farm 750 MW Wind Farm 500 MW BESS	☑	☑	☑	☒	☒	X
Bullawah Wind Farm	BayWa.Re	1 GW Wind Farm 500 MW BESS	☑	☑	☑	☒	☑	X
Baldon Wind Farm	Goldwind Australia	900 MW Wind Farm	☑	☒	☑	☒	☑	X
Wilan Wind Farm	Kilara Energy	800 MW Wind Farm 200 MW BESS	☑	☑	☑	☒	☒	X
Grid Connection	Grid Operator	N/A	☑	☑	☒	☑	☒	X

Preferred Option ✓

Potential HRS Sites

Four locations have been identified for assessment as potential HRS sites in Hay Shire.



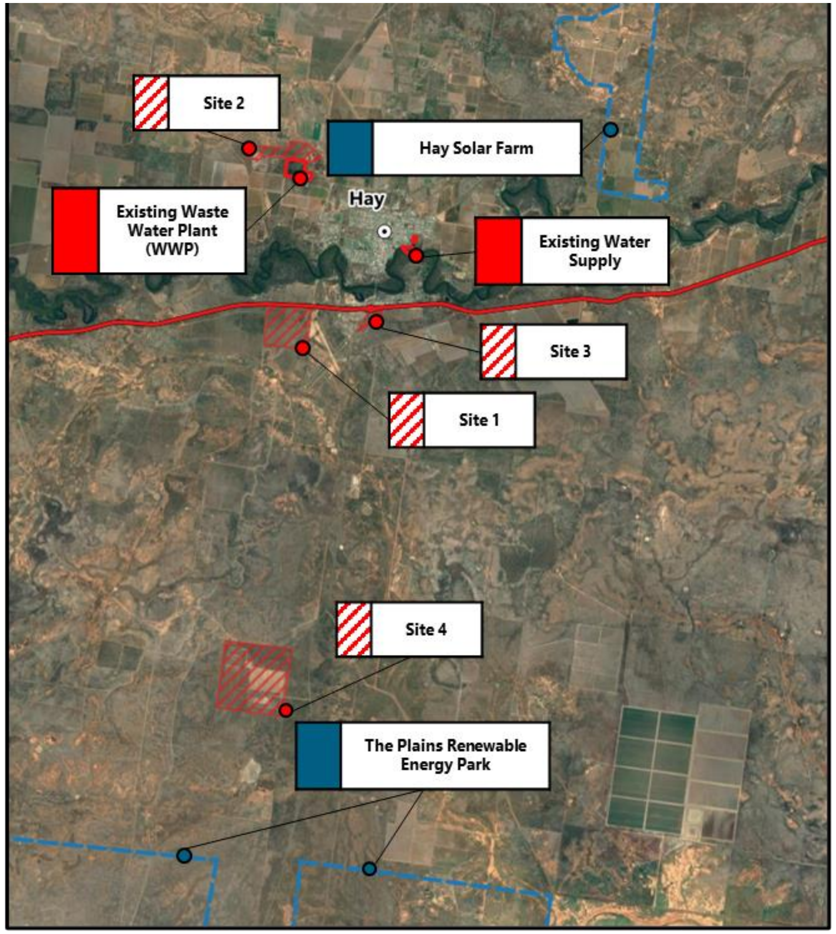
	Site 1	Site 2	Site 3	Site 4
Owner	The Parraway Parcel (Macquarie Bank)	Hay RRE	Crown Land (Travelling Stock Route)	Australian Food & Fibre
Location	26609 Sturt Highway, Hay South (Lot 1 DP1124296)	109 Thelangerin Road, Hay (Lot 113 DP448476)	Cobb Highway, Hay South (various Lots/DPs)	10991 Cobb Highway, Hay South Lot 21 DP756797
Plot Size	1.2 km^2	0.5 km^2	0.2 km^2	2.6 km^2
Distance to Waste Water Plant	~3 km (River crossing required)	Adjacent	~3 km (River crossing required)	~11 km (also raw water connection on site)
Distance to Nearest RE Source	~ 8 km (Hay Solar Farm) ~ 12 km (The Plains)	~7 km (Hay Solar Farm) ~ 16 km (The Plains)	~ 8 km (Hay Solar Farm) ~ 13 km (The Plains)	~ 4km (The Plains)
Distance from Sturt Highway	Adjacent	~ 4km	Adjacent (at Sturt/Cobb highway junction)	~ 8km

Potential HRS Sites – ESG Considerations

Site location	View	Land Zoning	Attributes and considerations
Site 1: 26609 Sturt Highway, Hay South (Lot 1 DP1124296) – South plot only		RU1 Primary Production	• Agricultural use associated with “Mungadal” merino stud. • Located about 600m to west of Hay Airport boundary and Hay Golf Course (public). • “Mungadal” farm house located 300m to the north. Next closest sensitive receptors (residential) located over 1km to the east. • Partly mapped as sensitive area under LEP for biodiversity. • Potential for partial flood inundation from nearby Murrumbidgee River (0.2%, 0.5%, 1%, 2 and 5% AEP according to Hay and Maude Flood Study). • Partly mapped as Bushfire prone land (Vegetation Buffer).
Site 2: 109 Thelangerin Road, Hay (Lot 113 DP448476)		RU1 Primary Production	• Largely vacant land, with some small buildings associated with the Hay Community Recycling Centre. • Surrounding land use is waste disposal facility, sewage treatment plant and agriculture. • Nearest sensitive receptors (farm houses) located around 200m to the north and east of the site. • Small eastern portion of site mapped as sensitive area under LEP for biodiversity. • Potential for partial flood inundation from nearby Murrumbidgee River (0.2% and 0.5% AEP according to Hay and Maude Flood Study).
Site 3: Cobb Highway, Hay South (various Lots/DPs)		RU1 Primary Production	• Agricultural use on Crown land/reserve with some vegetation (managed by Local Land Services as a travelling stock reserve). • Surrounding land use is agriculture, Hay Airport and mixed uses including two petrol stations. • Located about 150m to the east of Shear Outback building and 200m south of Motel Hay. • Mapped as sensitive area under LEP for biodiversity. • Potential for partial to full flood inundation from nearby Bungah Creek (20% to 0.2% AEP according to Hay and Maude Flood Study). • Mapped as Bushfire prone land (Vegetation Category 1 and Vegetation Buffer).
Site 4: 10991 Cobb Highway, Hay South Lot 21 DP756797		RU1 Primary Production	• Agriculture use associated with the Auscott Limited Cotton Mill including buildings and infrastructure (built in recent years). • Surrounding land use is agriculture. • Nearest sensitive receptors (farm houses) located over 1km away from site. • Mapped as sensitive area under LEP for biodiversity.

Options Screening – Preferred HRS Site

Location at the junction of the Sturt and Cobb highways and within close proximity to Hay make the Crown Land Parcel (site 3) the preferred HRS site.



	Site	Site 1	Site 2	Site 3	Site 4
		The Parraway Parcel	**Hay RRE**	**Crown Land Parcel**	**Australian Food & Fibre Parcel**
	Location	26609 Sturt Highway, Hay South (Lot 1 DP1124296)	109 Thelangerin Road, Hay (Lot 113 DP448476)	Cobb Highway, Hay South (various Lots/DPs)	10991 Cobb Highway, Hay South Lot 21 DP756797
Key Criteria	Adequate Size (>10a)	☑	☑	☑	☑
	Adjacent to Sturt Highway	☑	☒	☑	☒
	Adjacent to Cobb Highway (expansion)	☒	☒	☑	☑
	Proximity to Water Source (<5km)	☑	☑	☑	☑
	Proximity to Preferred Energy Source (<15km)	☑	☒	☑	☑
	Safety (>1km from built up area)	☒	☒	☒	☑
	Environment (<fully mapped as sensitive area)	☑	☑	☒	☒
	Priority	?	X	✓	X

Preferred Option ✓ Potential Alternative ?

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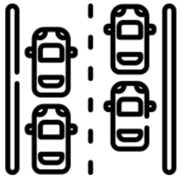
Sizing refuelling stations

The size and configuration of the refuelling stations has been developed giving consideration to a essential design factors.



Traffic flow

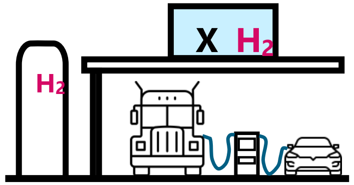
Forecast traffic volumes were assessed as a key deterministic variable in sizing the refuelling station.

Traffic volumes were underpinned by market share estimates and forecast hydrogen penetration rates for each location.

Vehicle Parameters

Current Heavy Duty FCEV market assessment was undertaken to identify technical parameters including fuel economy, range tank pressure.

Benchmarking against current ICE fleet to estimate higher haulage vehicles not currently available. Forecast efficiency improvements resulting in improved fuel economy and range considered as more vehicles are released



HRS Size

Nominal demands were calculated for the 2030 and 2050 scenario based on current and forecast vehicle parameters and traffic flow.

Three configurations have been proposed to service the demand

Preferred options selected to provide flexibility to scale investment and capacity as market uptake increases

From Market Assessment

Refuelling Station Nominal Capacity

2030 nominal hydrogen capacity for the HRS will be based on an expected demand of ~0.6 tpd.

Hydrogen and Water Demand Calculation						
Conditions	**2030**			**2050**		
Total Expected # of FCEV Trucks / day	11			262		
Expected Market Share[2]	100%			33%		
Equivalent number of vehicles based on expected market share	11			87		
	Heavy Rigid		**Articulated**	**Heavy Rigid**		**Articulated**
Vehicle Size (tonnes) (GVM for HR/GCM for Articulated)	4.5 – 27		Up to 70	4.5 – 30		Up to 100
Expected Average Fuel Consumption (kg/100km)	8.5		13	7.5		11.9
Expected average FCEV Range (km)	~600		~400	~800		~600
Expected average H2 Consumed for Range (kg)	60		55	70		80
Nominal Hydrogen Demand Served by Proponent refuelling stations (tpd)	**min**	**avg**	**max**	**min**	**avg**	**max**
	0.4	**0.6**	**0.8**	**3.3**	**5.7**	**6.7**

- Hay Shire is approximately ~750 km from Sydney and is well situated to provide a HRS:
  - Current hydrogen re-fuelling stations are mostly focussed around major/capital cities. Assuming that each capital city has a refuelling station and considering a range of 800 km between re-fuelling:
    - **1 re-fuelling station** is required **between Sydney and Adelaide**
    - **4 re-fuelling stations** between **Sydney and Perth**.
  - For the shorter range vehicles (400 km) an additional re-fuelling station will be required between Sydney and Hay Shire. It is likely that this will be provided by the Hume Hydrogen highway project (before the Sturt branches off).
- The expected average FCEV Truck hydrogen consumption is based on:
  - Consumption for existing Hydrogen heavy vehicles, covering up to 70t configurations (refer to Market Assessment section).
  - Forecast improvements in range and efficiency (~30%) expected to be achieved by 2050[3]
- Expected hydrogen refuelling demand is calculated based on the total number of FCEV trucks expected per day, expected market share and estimated refuelling requirements (above):
  - 2030 hydrogen refuelling demand is expected to average at ~600kgs/day
  - This is expected to increase to ~5.7 tonnes/day by 2050
- HRS designs will consider the configurations required to meet expected demand, with additional consideration of expansion options for one station or multiple stations that may be required.

1. *https://www.transportenvironment.org/wp-content/uploads/2021/07/2020_06_TE_comparison_hydrogen_battery_electric_trucks_methodology.pdf*
2. *100% capture of market in Hay in 2030, 33% capture of market in Hay in 2050*
3. https://theicct.org/wp-content/uploads/2022/07/fuel-cell-tractor-trailer-tech-fuel-1-jul22.pdf

HRS Design Configurations – Hay Shire

Various HRS sizes and configurations have been considered, providing the optionality for gradual scaling or upfront investment in a single or multiple sites to meet expected demand.

		HRS Design Configurations	
DESIGN	**Suggested HRS size**	 **Medium**	 **Extra Large**
	H_2 Production & Refuelling Capacity	~1tpd	~3tpd
	Hydrogen Source	• On-site electrolysis	• On-site electrolysis
	Key Inputs	• Locally sourced renewable energy and water	• Locally sourced renewable energy and water
	Optimal End Use Customer	• Heavy haul vehicles for interstate logistics	• Heavy haul vehicles for interstate logistics • Potentially local agricultural vehicles
Scale and Timing Considerations	**Advantages**	• Most cost-effective size to meet expected H_2 demand for 2030	• Less downtime required to scale to capture demand post 2030.
	Disadvantages	• Requires expansion to meet increases in H_2 demand between post 2032	• Larger upfront capital investment translates into higher investment risk.

**Percentage of heavy vehicles captured by Hay Shire expected to be ~33% in 2050*

Conditions	**2030**	**2050**
Total Expected # of FCEV Trucks per day	11	87
Expected Total H_2 Demand	~0.6tpd	~5.7tpd
No. of HRS's Required to Fulfill Demand	1 Med	2 XL

2030 — Development options to meet expected future demand — 2050

Phased Investment

Progressively phase investment to maximum capacity to meet expected demand:

- Start with Medium (1000kg/d) and gradually expand to Extra large (3000kg/d) on the initial site as demand increases
- Option to add another Medium site in 5-10 years and expand to Extra large (3000kg/d) to meet total expected demand by 2050, depending on desired market capture.

Upfront Investment

Upfront investment in maximum capacity:

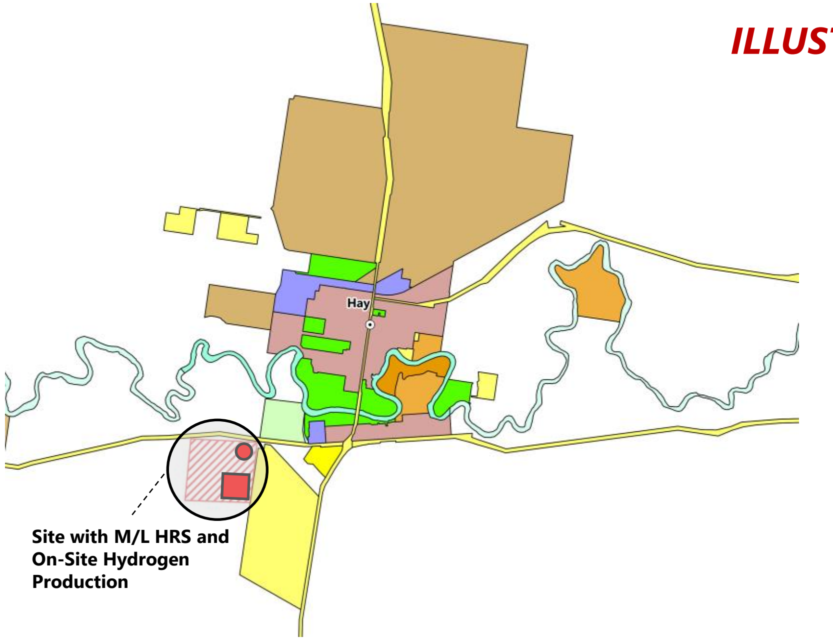
- Start with an Extra large (3000kg/d) on the initial site
- Option to add another Extra large (3000kg/d) site in 5-10 years to meet total expected demand by 2050, depending on desired market capture.

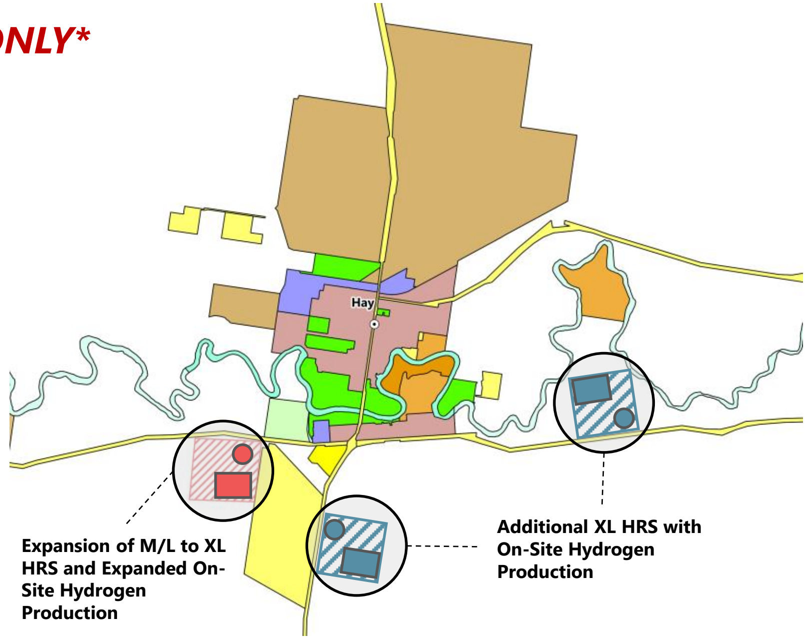
Optimal Design Configurations – Phased Development

Three Extra Large HRS's will be required to meet the demand for Hydrogen in Hay by 2050.

2030 Scenario	2050 Scenario

ILLUSTRATIVE ONLY*





2030 Scenario

- Single large/medium sized HRS will have capacity to facilitate forecasted hydrogen demand for Hay in 2030.
- On-site hydrogen production facility will reduce keep footprint low and reduce piping cost for site.

2050 Scenario

- Minimum of 3 extra large sized HRS's with Hydrogen production will be required to meet forecasted hydrogen demand for Hay in 2050.
- Phasing may start with expanding existing large/medium sized to extra large sized HRS before constructing 2 extra large HRS's on different sites.
- Alternatively, to ensure security of supply, a second extra large station may be built first before expansion of the existing large/medium sized HRS.

**Scenario's are illustrative only. Represent a possible phasing plan to accommodate 2030 to 2050 demand of Hydrogen in Hay.*

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Hydrogen Refuelling Delivery Model Overview

Partnerships along the value chain are expected to be required for a Proponent to achieve an effective hydrogen refuelling delivery model in Hay Shire

Hydrogen Refuelling Delivery Model

The delivery model should be based upon two key aspects: a robust facility design and the proponent establishing strategic partnerships along the value chain, including end customers. This strategy will promote successful delivery and offtake security, thus providing a solid basis for the investment decision.

Facility Design Strategy

To deliver a fit-for-purpose hydrogen refuelling facility, the HRS design configurations need to be optimised, accounting for size, hydrogen source, expected traffic volume, type of vehicle, as well as the optimal end user.

Optimal Design Configurations

Optimal design configuration options have been identified for each target location based on the outcomes of the location analysis and HRS technical design.

Proponent Partnership Strategy

The proponent for the HRS development in Hay Shire could be any one of the participants along the Hydrogen production and refuelling value chain.

Irrespective of the proponent, strategic partnerships with other players along the value chain are likely to be required to secure hydrogen feedstock and offtake.

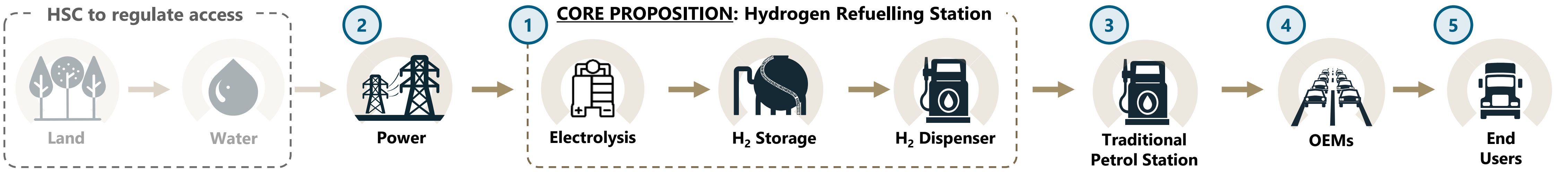
Specific partnership structures will vary dependent on the proponent's development scope and risk appetite.

Partnership Opportunities

Partnership opportunities are identified, assessed and prioritised in terms of the partnership type and the demonstrated use cases in the slides that follow.

Potential HRS proponents

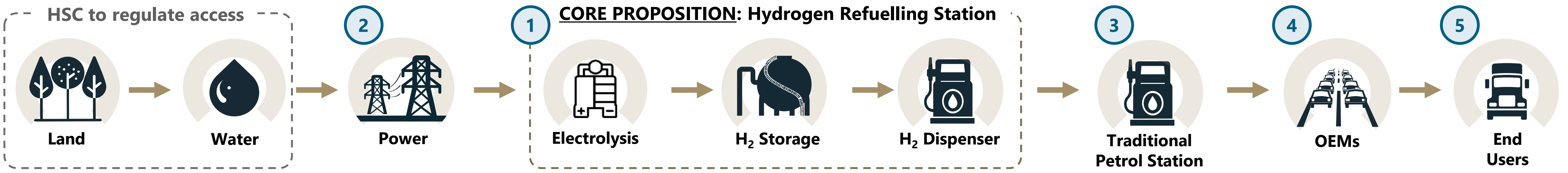
Apart from standalone HRS investors, value chain participants seeking upstream/downstream integration opportunities could present as potential development proponents.



Potential Proponents		Scope & Investment Rationale	Preferred Proponent Profile
1	**Standalone HRS Investor**	• Invest in HRS to capitalise on the potential uptake of H2 for heavy transportation	• Demonstrated Hydrogen production and/or HRS capability (existing owner/operator), ideally within Australia
2	**Renewable Energy Producer**	• Integrate upstream by investing in HRS to diversify energy offering and secure renewable energy offtake	• Demonstrated capability to "build, run, fund" renewable energy projects >500 MW within Australia (supported by Balance Sheet strength) • Existing or proposed Renewable Energy project near Hay or within NSW
3	**Existing Petrol Refuelling Station**	• Invest in HRS to promote continued relevance of existing operations and balance investment exposure to a gradual energy transition	• Existing refuelling station in or near Hay • Large multinational brand with existing or proposed HRS's in Hay/NSW
4	**FCEV OEMs**	• Invest in HRS to provide end user security and accelerate the uptake of H2 for heavy transportation	• OEM with existing or proposed large FCEV / Truck / Heavy Haul offering in Australia • Existing or proposed HRS investment and/or existing operational HRS (global)
5	**FCET End Users (Logistics)**	• Fast track adoption of FCEVs in Heavy Line Haul industry • Decarbonise supply chain and establish HRS for fleet	• Proven Heavy Line Haul operator along Sturt with decarbonisation aspirations
Assumptions		• HSC will provide and regulate access to land and water supply, but is not a potential proponent • All proponents could consider further upstream and downstream partnerships where available/desired to suit their risk appetite	

Proponent partnership options

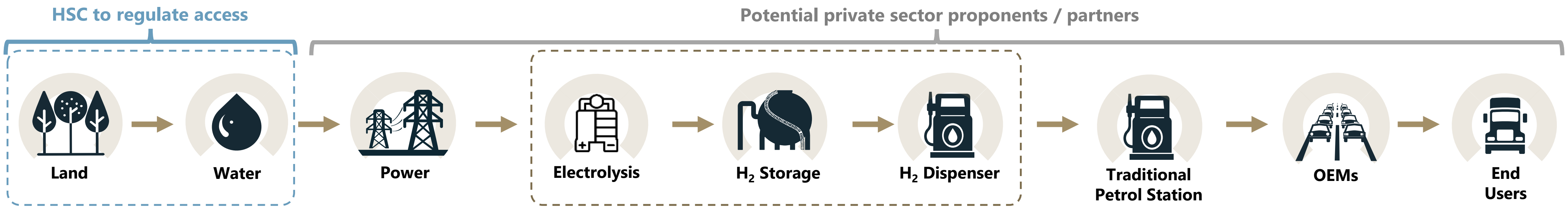
Proponents could also enter into upstream or downstream partnerships along the value chain. Available partnership options vary depending on the proponent.



Potential Partner	Primary Partnership Objective for the Proponent				
	1. Standalone HRS Investor	**2. Renewable Energy Producer**	**3. Existing Refuelling Station**	**4. FCEV Truck OEMs**	**5. End Users**
Renewable Energy Producer	Secure renewable electricity supply for Hydrogen production		Secure renewable electricity supply for Hydrogen production	Secure renewable electricity supply for Hydrogen production	Secure renewable electricity supply for Hydrogen production
Existing Refuelling Station	Leverage existing refuelling site / infrastructure / operating knowledge and reputation	Leverage existing refuelling site / infrastructure / operating knowledge and reputation		Leverage existing refuelling site / infrastructure / operating knowledge and reputation	Leverage existing refuelling site / infrastructure / operating knowledge and reputation
FCEV Truck OEMs	Develop and invest in FCEV truck technology to promote uptake of Hydrogen as a fuel for heavy transportation	Develop and invest in FCEV truck technology to promote uptake for Hydrogen for heavy transportation	Develop and invest in FCEV truck technology to promote uptake for Hydrogen for heavy transportation		Develop and invest in FCEV truck technology to promote uptake for Hydrogen for heavy transportation
End Users	Secure refuelling station hydrogen offtake	Secure refuelling station hydrogen offtake	Secure refuelling station hydrogen offtake	Secure refuelling station hydrogen offtake	
Assumptions	Engagement mechanisms with HSC will be required to facilitate and regulate proponent access to land and water supply				

Partnership models and engagement mechanisms

Several models and mechanisms are available to facilitate partnerships along the value chain.



	Partnership Models	Description
Private Sector	**Joint Venture**	Combination of two or more parties that seek the development of a project, sharing ownership. Separate legal entities and integrated risk sharing (or as per JV agreement).
	Shared Services	Private partnership where the Proponent will look to leverage existing operations on site by signing a shared service agreement with complementary businesses.
	Co-Investment	The Proponent and other private entities co-invest in a specific business venture. Separate legal entities and ownership of risks.

	Engagement Mechanisms	Description
Hay Shire	**Concessions**	Concession contract signed between Hay Shire and the Proponent will allow for public authority to retain some control over specification, installation, operation and use of the infrastructure. Revenue sharing between two parties and financial support from Hay Shire would be outlined in concession contract.
	Joint Venture	Hay Shire and the Proponent create a join venture company through control of the infrastructure is shared. Risks are shared according to stakes in the join venture. Financing arrangements may come from one or both parties, and user revenues shared according to stake.
	Build-Operate-Transfer (BOT)/ Build-Operate-Own (BOO)	Hay Shire grants right to develop and operate facility for a certain period to the Proponent. In BOT, the Proponent finances, constructs, and operates facility before transferring back to Hay Shire. For BOO, the Proponent retains ownership of the asset at end of contract instead of transferring it back to the Hay Shire.

Potential Renewable Energy Provider Partners/Proponents

Renewable energy providers with existing or proposed projects in Regional NSW could present as potential proponents or partners for a HRS development in HSC.

Energy Provider Partner	Description	Local Renewables Project	Partnership Model	Potential Use Case	Key Criteria: Local RE Project with >500 MW Capacity	Key Criteria: Capability for "Build, Run, Fund"	Key Criteria: <20 km to Hay	Key Criteria: >$0.5bn/yr turnover	Key Criteria: Existing Australian Portfolio >500 MW	Priority
Engie	Engie is a French utility company with a global presence across energy sector (natural gas, petroleum, renewable, etc.). Has capability across the energy value chain.	The Plains Renewable Energy Park	Joint Venture/Co-Investment	Partnership to secure renewable energy from local providers. Provides a vertical integration opportunity for upstream partners to explore hydrogen production opportunities.	☑	☑	☑	☑	☒	✓
Neoen	Neoen is a French utility company that focuses solely on renewable energy. Large portfolio of renewable projects spanning 16 countries with an installed capacity of up to 5 GW.	Tchelery Wind Farm	Joint Venture/Co-Investment		☑	☑	☒	☑	☑	✓
Someva Renewables	Someva is a specialist renewable energy developer and advisor in Australia, with a focus on providing lower cost electricity for future Australian generations.	Pottinger Energy Park	Joint Venture/Co-Investment		☑	☑	☑	☒	☒	✓
Island Power UK	Island Green Power UK is a renewables energy developer with projects in the UK, Spain, Australia, Ireland and Italy. Total Global Installed Capacity of ~700 MW.	Hay Solar Farm	Joint Venture/Co-Investment		☒	☑	☑	☒	☒	?
Goldwind Australia	Goldwind Australia is a subsidiary of the Chinese company Goldwind International. Parent company is a major player in renewable energy sector with over 100 GW installed capacity as of 2023.	Baldon Wind Farm	Joint Venture/Co-Investment		☑	☑	☒	☑	☒	?

High Priority ✓ Further assessment required ?

Potential Refuelling Station Partners/Proponents

Fuel station operators with existing fuel stations in HSC or along the Sturt Highway could present as potential proponents or partners for a HRS development in HSC.

Refuelling Station Partner	Description	Preferred Vehicle for Refuelling	Partnership Model	Potential Use Case	Key Criteria Operating in HSC	Priority
7-Eleven	Leading fuel and convenience store providers in Australia with almost 750 nationally. Partners with Mobil as a fuel provider.	LV's, R2B, LCVs	Joint Venture/Shared Service	Partnership to leverage existing fuel station infrastructure and operating knowledge within HSC to integrate hydrogen refuelling Provides existing refuelling station with the opportunity to promote the continued relevance of existing operations and balance investment exposure to a gradual energy transition.	☒	?
Coles Express	Leading fuel and convenience retailers with 723 stores across Australia. Partners with Shell as a fuel provider.	LV's, R2B, LCVs	Joint Venture/Shared Service		☒	?
EG Group	Recently acquired the Woolworths national fuel network for $1.7bn. Fuel and convenience retailer with almost 500 across Australia. Partners with Ampol as a fuel provider.	LV's, R2B, LCVs	Joint Venture/Shared Service		☒	?
bp	Major UK petroleum brand with >1,400 service stations across Australia.	All	Joint Venture/Shared Service		☒	?
Mobil	Major US petroleum brand with >900 service stations across Australia (inclusive of the 7-Eleven Fuel Network). ~200 service stations independently owned.	All	Joint Venture/Shared Service		☒	?
Shell	Major Dutch petroleum brand with extensive national network of >1,000 service stations across Shell Coles Express, independently operated & Liberty service stations	All	Joint Venture/Shared Service		☑	✓
Ampol	Australia owned petroleum company. Operates ~1,900 branded sites (inclusive of the EG Fuel Network)	All	Joint Venture/Shared Service		☑	✓

High priority ✓ Further assessment required ?

Potential FCEV Truck OEM Partners/Proponents

FCEV Truck OEMs with existing or planned Heavy Transport offerings in Australia could present as potential proponents or partners for a HRS development in HSC.

FCEV Partner	Description	Partnership Model	Potential Use Case	Key Criteria: Availability in Australia	Key Criteria: FCEV heavy vehicle currently on market	Priority
Hyzon	FCEV supplier becoming established in Australia. Wide range of vehicles that are suitable for future hydrogen mobility projects. Signed a partnership with Hiringa Energy to deliver 1,500 FCEV trucks in New Zealand by 2026.	Joint venture / Co-investment	Partnership to further develop existing FCEV heavy haul vehicles and introduce/develop other FCEV heavy haul vehicles in Australia.	☑	☑	✓
Hyundai	Established OEM, HRS pilot in operation for LVs. Global reach, reputable company and supplier of FCEV.	Joint venture / Co-investment		☒	☑	?
Kenworth/ Toyota	Partnership between Kenworth and Toyota for development of FCEV truck (T680 FCEV). Heavy vehicle is currently in development. Mass production expected to begin in 2024.	Joint venture / Co-investment		☒	☒	?
Nikola	American company with focus on BEV and FCEV heavy haul vehicles. Currently as one operating FCEV truck on the market (Nikola Tre FCEV).	Joint venture / Co-investment		☒	☑	?

High priority ✓ Further assessment required ?

Potential End User Proponents/Partners

Existing heavy line haul logistics companies operating along the Sturt Highway could present as potential proponents or partners for a HRS development in HSC.

Logistics Partner		Description	Preferred Vehicle	Partnership Model	Potential Use Case	Key Criteria: Presence in SYD	Presence in ADL	Presence in PER	Heavy Haul Focus	Priority
Australia Post	AUSTRALIA POST	Government run enterprise, major logistics provider in Australia. Over 20,000 vehicles Australia wide, majority are LCVs for intracity logistics.	All, primarily LCVs and LVs to facilitate courier service	Joint Venture/Shared Service	Partnership agreement to fast track adoption of FCEVs in transport industry. For hydrogen producer secures revenue stream via offtake agreement.	☑	☑	☑	☒	?
Fedex	FedEx	One of the largest logistics companies worldwide. Over 2,000 vehicles Australia wide.	All, primarily LCVs and LVs to facilitate courier service	Joint Venture/Shared Service		☑	☑	☑	☒	?
Toll	TOLL	Major logistics provider in Australia, offering warehousing, sea, air, road and rail freight services. Over 10,000 vehicles Australia wide.	All, primarily LCVs and LVs to facilitate courier service	Joint Venture/Shared Service		☑	☑	☑	☒	?
Global Express	TEAM GLOBAL EXPRESS	Originally Toll's Parcel and Pallet division. Major multi-modal transport business across Australia & New Zealand. Fleet of ~1,500 prime movers.	Prime Movers, Rigid Trucks, LCVs	Joint Venture/Shared Service		☑	☑	☑	☑	✓
Linfox	LINFOX	Australia owned major transport, logistics and supply chain provider. Largest fleet of prime movers (~2,000) in Australia. A primary logistics company for Coles.	Prime Movers, Rigid Trucks, LCVs	Joint Venture/Shared Service		☑	☑	☑	☑	✓
K&S Group	K&S CORPORATION LIMITED	Australia owned major transport, logistics and supply chain provider. Considerable fleet of prime movers (~1,500) in Australia.	Prime Movers, Rigid Trucks, LCVs	Joint Venture/Shared Service		☑	☑	☑	☑	✓
Mainfreight Australia		Global supply and logistics company originating from New Zealand. Prime mover fleet in Australia estimated at ~500.	Prime Movers, Rigid Trucks, LCVs	Joint Venture/Shared Service		☑	☑	☑	☑	✓

High priority ✓ Further assessment required ?

Potential Proponent and Partnership Summary

Delivery model configurations for a HRS development in Hay Shire are structured around the choice of Proponent and associated partnerships along the value chain.

Business Model

	Independent HRS Investor	Power Producer	Existing Petrol Station	OEMs	End User
Proponent	**Independent HRS Investor**	**Power Producer**	**Existing Petrol Station**	**OEMs**	**End User**
Business Case	Independent Third Party for HRS to be developed in Hay.	Local Power Generator to integrate downstream and take ownership of Hydrogen production.	Existing fuel providers to expand offering to green hydrogen, leveraging existing operational footprint to accelerate a hydrogen refuelling network.	Existing Hydrogen FCEV OEM's to integrate upstream and provide supply for heavy haul catalogue.	Heavy Haul logistic companies take ownership of hydrogen supply for Hydrogen FCEV fleet.
Proponent's Scope	• Hydrogen Production (Electrolysis to Storage)	• Power • Hydrogen Production (Electrolysis to Storage)	• Hydrogen Production and Refuelling (Electrolysis to H_2 Dispensing)	• Hydrogen Production (Electrolysis to Storage) • OEMs	• Hydrogen Production (Electrolysis to Storage) • End Use of Produced Hydrogen
Priority Partners*	End User: LINFOX RE Providers: NEOEN, ENGIE	End User: LINFOX RE Providers: NEOEN, ENGIE	End User: LINFOX RE Providers: NEOEN, ENGIE	End User: LINFOX RE Providers: NEOEN, ENGIE	OEMs: HYZON RE Providers: NEOEN, ENGIE
Secondary Partners*	OEMs: HYZON Fuel Retailers: AMPOL, Shell	OEMs: HYZON Fuel Retailers: AMPOL, Shell	OEMs: HYZON	OEMs: HYZON Fuel Retailers: AMPOL, Shell	Fuel Retailers: AMPOL, Shell

**Non exhaustive list – refer to interim report for full partner list*

Delivery Model Use Cases

Renewable Energy Partners/Proponents – Case Study: Yuri Project

Engie, Mitsui and Yara Pilbara Fertilisers have partnered to develop a 640tpa green hydrogen facility as feedstock for Yara's existing ammonia production facility.

Opportunity for Renewable Energy Providers to integrate into Hydrogen Production

Partnership Opportunity:

- Three-way partnership to gain access and diversify risk across the hydrogen value chain.

Benefits to Engie:

- Provides opportunity to integrate downstream into Hydrogen Production.
- Offtake secured with Yara Fertilisers greatly derisks the project.
- Opportunity for Engie to gain valuable hydrogen production know-how in addition to leveraging its existing renewable energy experience.

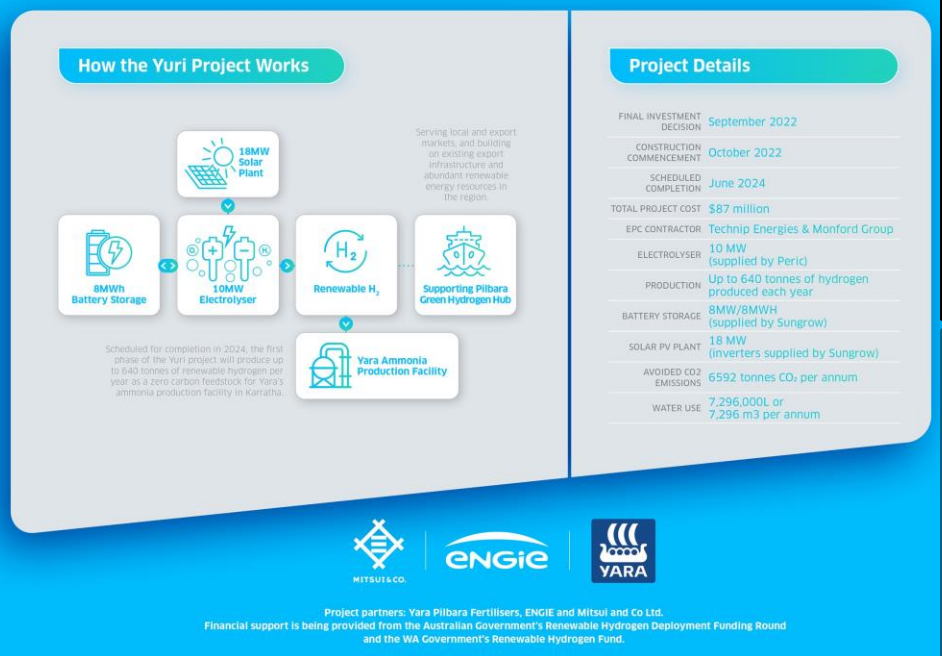
Benefits to Mitsui:

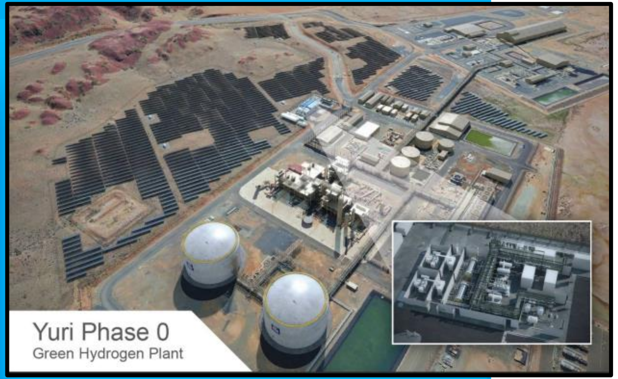
- Export and trade opportunity with part ownership of Hydrogen Production Facility.

Benefits to Yara Pilbara Fertilisers:

- Zero-carbon feedstock for existing ammonia production facility in Karratha.
- Commitment to 2050 Carbon Neutral pledge.

Hydrogen Production for Industrial Usage





ARENA funded projected with Mitsui and Engie supplying remaining equity.

Hydrogen production secured by offtake with Yara Pilbara Fertilisers.

Refuelling Station Partners/Proponents – Case Study: bp Truck Stop

bp partnered with BOC to add a hydrogen refuelling station at the bp truckstop in Lytton

Opportunity to leverage existing service stations for hydrogen refuelling

Partnership Opportunity:
- Partnership to leverage available infrastructure for FCEV integration

Benefits to BOC
- Utilising established refueling network to meet mobility needs of its customers.
- Streamlining approvals and stakeholder engagement process due to established refueling stations
- Integrates FCEV routes with existing commercial routes, minimising implementation barriers

Benefits to BP
- Ability to extend the lifetime of existing sites and infrastructure
- FCEV implementation aligns with ESG and decarbonisation corporate targets

Existing refuelling station that can readily integrate FCEV's

Significant opportunity to leverage existing service station operational footprint.

End User & OEMs – Case Study: New Energies Service Station

Viva Energy has partnered with its End Use Customers including Toll Group (Logistics), Cleanaway (Waste) and CDC (Bus) to create a hydrogen mobility network.

Opportunity to leverage existing end-use customers to create a turnkey hydrogen solution

Partnership Opportunity:

- Partnership between hydrogen producer and end user customers to create a holistic solution for the delivery of hydrogen vehicles and the supply of hydrogen

Benefits to Viva Energy

- Partnership with Hyzon and other OEMs to supply FCEV vehicles to End Use customers provides a turnkey solution for its hydrogen production.
- First mover advantage for producing a viable commercial solution across the entire hydrogen value chain.

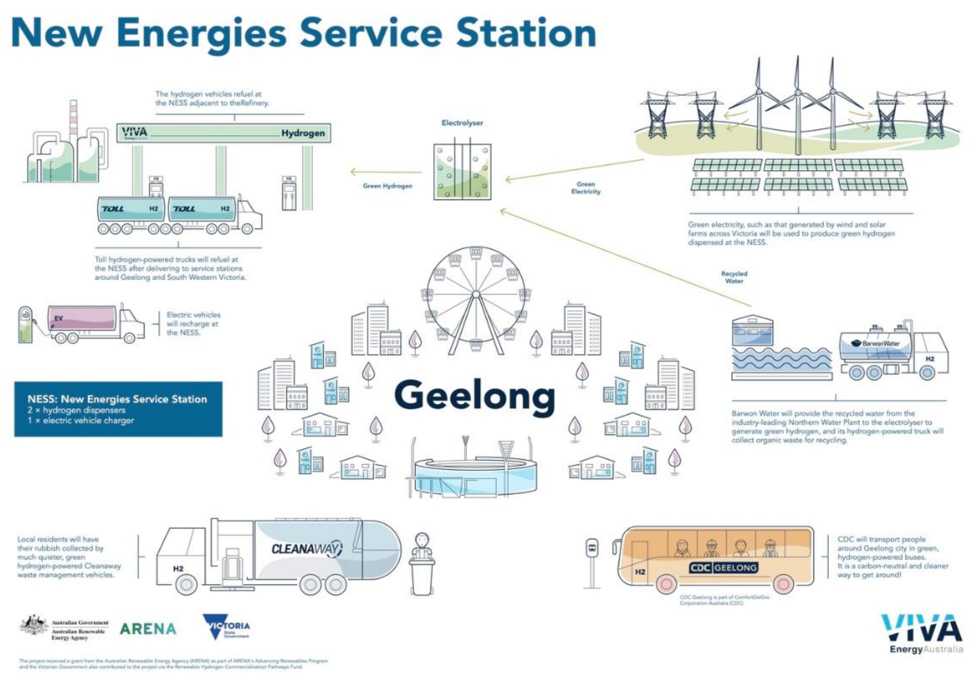
Benefits to OEMs (ie. Hyzon)

- Opportunity to increase Australian market share through supply of FCEV vehicles to Viva Energy's customer base.

Benefits to End Use Customers (ie. Toll, Cleanaway, CDC)

- Turnkey solution provides low-risk access into hydrogen mobility network.
- FCEV implementation will align with ESG and decarbonisation corporate targets

Hydrogen Mobility Hub in Geelong



Infographic by Viva Energy Australia

Viva Energy will operate as the integrated hydrogen producer, supplying hydrogen to its End Use Customers via the New Energies Service Station (NESS).

Barwon Water will provide recycled water for Hydrogen Production

Viva Energy has partnered with Hyzon and other OEMs to supply FCEV Vehicles for its End Use Customers.

End User & OEMs – Case Study: Engie Cofely H2 Utility fleet

Engie has partnered with Renault, Semmaris and Alphabet to develop France's largest hydrogen utility fleet and first alternative multi-fuel station to service the region of Île-de-France.

Opportunity to leverage existing centralised services to establish a hydrogen utility fleet for leasing

Partnership Opportunity:
- Leveraging the 25k vehicles per day concentration at the Rungis market to accelerate green mobility in Île-de-France.

Benefits to Engie
- Positioning Engie as a forerunner in hydrogen applications for mobility and large-scale energy storage.
- Establishing its alternative fuel and recharging stations, with
- a presence in 30 countries and 980 cities around the world.

Benefits to OEMs
- Strengthening Renault's position as European leader in the van and electric UV segment and showcasing the Kangoo Z.E., the best-selling electric utility vehicle in Europe since 2011.

Benefits to End Use Customers
- Reliable access to ZE mobility, which aligns with ENGIE Cofely's energy and environmental services.
- Air quality is a major public health issue for Île-de-France.

Hydrogen Utility Fleet in the Île-de-France region

At the fresh produce market of Rungis, a fleet of 50 ZE Renault Kangoo was made available for long-term rental through Alphabet.

These vans are BEVs equipped with a hydrogen fuel cell range extender.

They will be used by ENGIE Cofely for multi-technical services in the Île-de-France region.

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Hydrogen Refuelling Financial Evaluation – Overview

The basis of the financial evaluation is a trade-off of HRS scale and capital investment phasing scenarios to determine the lowest levelised cost / highest return alternative.

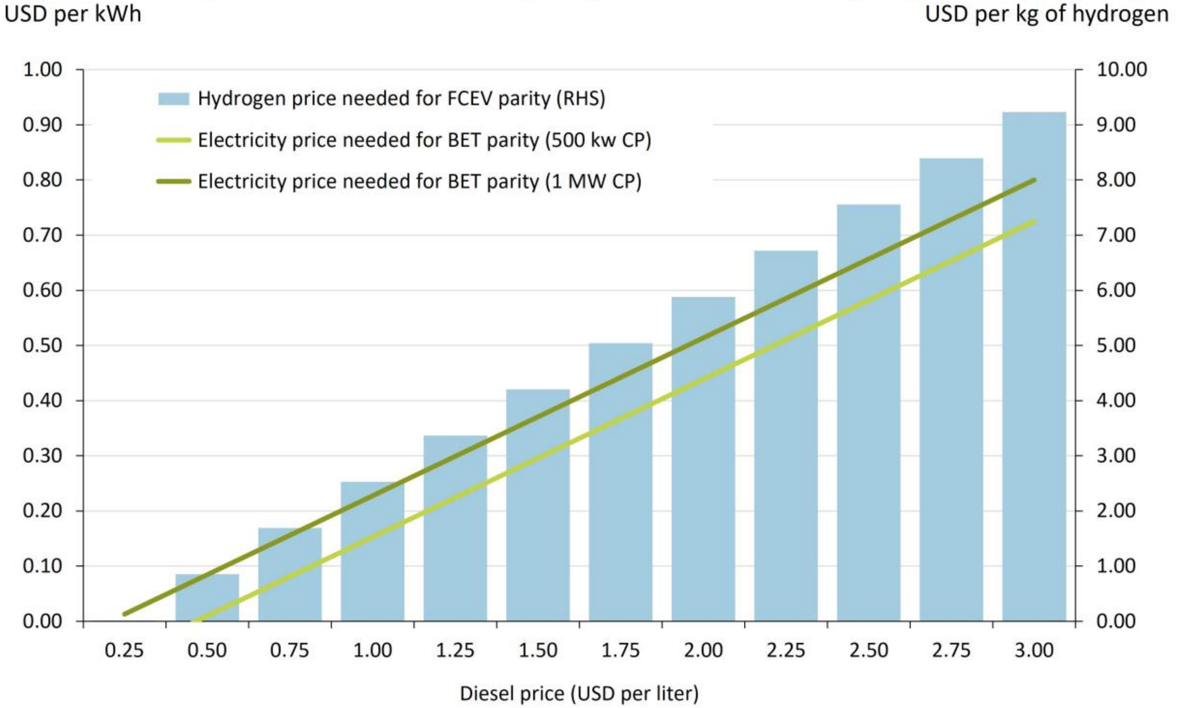
	Description
Approach	• Discounted Cash Flow (DCF) analysis based on cash flow forecasts for Revenue, Capital (CAPEX) and Operating (OPEX) costs, and Tax • DCFs are used to determine the Levelised Cost of Hydrogen (LCOH) for various scenarios, forming the basis of the cost/benefit analysis. • A break-even sensitivity analysis (i.e. NPV=0) is also performed. • The analysis assumes 100% equity contribution by the proponent.
Revenue & Pricing	• Revenue is derived primarily from the sale of Hydrogen to 3rd party Heavy Line Haul Transportation customers • Sales volumes are a function of HRS capacity, limited to the total forecast demand for HSC described in the Market Assessment section • Hydrogen retail pricing is based on Advisian forecasts, with a flat $5/kg assumed for the assessment period.
Cost Estimates	• CAPEX and OPEX estimates have been developed for the HRS design configurations defined as part of the Technology Options Development section • Cost estimates are AACEI Class 5 with an expected accuracy of +/- 50%
HRS Capacity Scenarios	• Given the Hydrogen Refuelling demand growth expectations described in the Market Assessment section, the HRS development proponent is likely to have several options for HRS start-up scale, expansion and investment phasing to capture the available market. • The HRS technical design configurations considered include Medium (1tpd), Large (2tpd) and Extra Large (3tpd) capacities. • The financial evaluation of the scale and investment phasing alternatives available to a proponent considers the following scenarios: - **Single Site Scenario**: a) Single site, phased expansion; b) Single site, upfront investment - **Multiple Site Scenario:** a) Multiple site, phased expansion; b) Multiple site, upfront investment
End User FCEV Truck Leasing Assessment	• The Business Model options assessment revealed that securing Hydrogen offtake would be a critical component of a prospective HRS business model. This would be achieved by partnering with Heavy Line Haul Transportation/Logistics companies through a FCEV Truck leasing model where the proponent purchases the FCEV trucks and leases them back to the End User, encouraging the uptake of FCEV Trucks and securing Hydrogen offtake without requiring or relying on significant upfront capital investment to be made by the End User. • A standalone Total Cost of Ownership (TCO) analysis is used to assess the financial implications of this model for both the proponent and the end user. • TCO's for both Internal Combustion Engine (ICE) and FCEV trucks were sourced from published studies and other Advisian analysis • For the purposes of the trade-off, the end user is assumed to be willing to incur a TCO equivalent to an ICE truck TCO plus a "green premium" for enabling emissions reduction in their supply chain.
Exclusions	• The financial evaluation does not consider demand and sale of Hydrogen relating to end-users other than Heavy Line Haul Transportation.

Hydrogen Refuelling Financial Evaluation – Hydrogen Pricing

The maximum End-Users are likely to pay for Hydrogen at the pump would be the current equivalent diesel price.

- For hydrogen participation in the heavy haulage market, hydrogen price must be able to have parity with existing diesel prices.
- A study by Rystad Energy studied the equivalent power and hydrogen prices for Battery Electric Trucks (BET) and Fuel Cell Electric Vehicles (FCEV), respectively, for differing diesel prices.
- Assuming a current diesel price of approximately $1.25 USD/L, the equivalent hydrogen price is approximately $3 USD/kg.H2 or **$5 AUD/kg.H2.**
- For the purposes of the financial evaluation, a flat $5 AUD/kg.H2 delivered to End-Users from the pump has been assumed for the operational lifetime of the HRS. This would represent the maximum End-Users would likely pay for Hydrogen produced.

Figure 5b: Fuel prices for BET and FCEV parity with diesel trucks (120,000 km per year)



1. *Rystad Energy – Hydrogen Fuelled Heavy Trucks Can Remain Viable in the Long Term (2023)*

Hydrogen Refuelling Financial Evaluation – HRS Cost Estimates

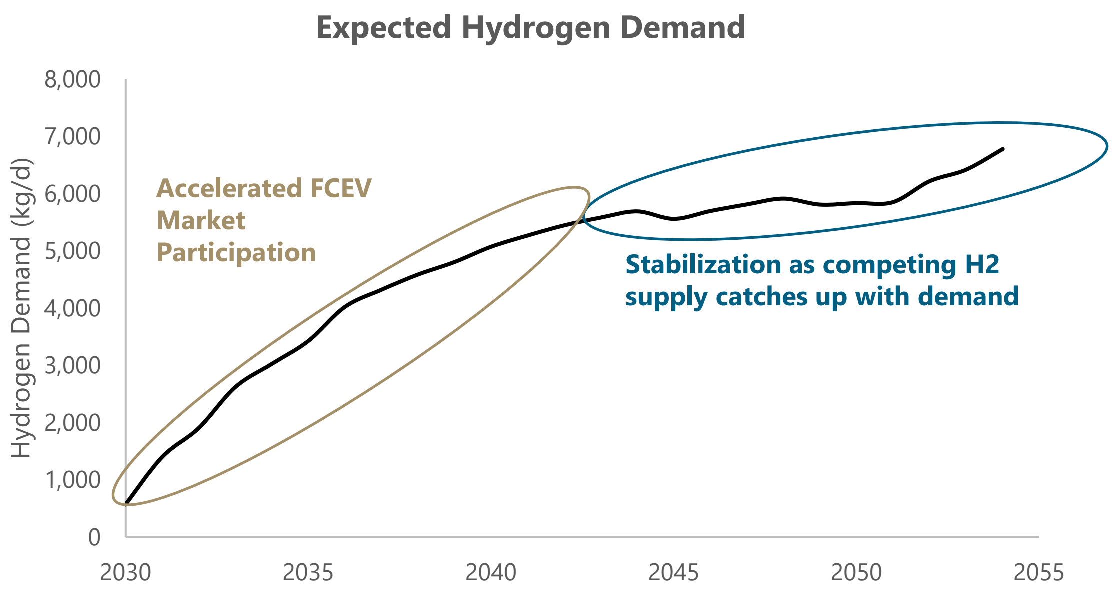
AACEI Class 5 (+/- 50% accuracy) CAPEX and OPEX estimates developed for developed for Medium, Large and Extra Large HRS design configurations.

		Size Basis			Notes
	Description	**Medium**	**Large**	**Extra Large**	
Design Parameters	Electrolyser Size	2.5 MW	5.0 MW	7.5 MW	• Medium, Large, and Extra Large HRS have been costed on a production value of 1,000 kg/d, 2,000 kg/d, and 3,000 kg/d, respectively.
	Electricity Input	60 kWh/kg			
	Water Input	17 L/kg			
	Hydrogen Dispensing Per Day	1,000 kg/d	2,000 kg/d	3,000 kg/d	
Capital Cost (2023 real)	Engineering & Design	$2.2m	$4.0m	$5.6m	• Cost Estimates are prepared in Australian Dollars, normalised to a base date of Q2, 2023 (no escalation beyond the estimate base date) • No allowance for Owners Cost has been made
	Project Management	$1.7m	$3.2m	$4.5m	
	Supply – Electrolyser Package	$5.2m	$10.5m	$15.7m	
	Supply – HRS Package	$2.8m	$4.7m	$6.2m	
	Supply – Balance of Plant	$6.8m	$12.3m	$17.5m	
	Installation, Commissioning, and Completion	$14.0m	$25.1m	$35.3m	
	Contingency at 30%	$9.8m	$17.9m	$25.5m	
	Total Capital Cost	**$42.7m**	**$77.7m**	**$110.4m**	
	Total Capital Cost ($/kg H2 Produced – 25 year life)	**$4.7/kg**	**$4.3/kg**	**$4.1/kg**	
Operating Cost (2023 real)	Annual Maintenance & Repair Expense	3% of Total CAPEX			
	Electricity Price	$0.12/kWh			• $120/MWh wholesale renewable electricity price assumed[1].
	Water Price	$0/L *(0.42/KL)**Note			**Note: upon initial completion of this study it was assumed that water supply and access to land would be provided by Hay Shire Council at no cost to the Proponent. Subsequently, it was confirmed that Hay Shire Council will supply water at $0.42 per kilolitre and land at a commercial lease rate of approximately $2.50 per square meter per year. Given the relative materiality of these costs compared to the cost of electricity, the updated costs have not been carried through to the financial evaluation. A high-level analysis indicated that inclusion of these costs would only increase the levelised cost outcomes by between 1% to 2.5%, confirming that the inclusion of these costs is not expected to change any of the outcomes or recommendations of the study.*
	Land Lease Cost	$0 per month *($2.50/m2 per year)* *Note			
	Balance of Plant - (Markup on Water & Electricity Costs)	20%			
	Total Operating Cost ($/kg H2 Produced – 25 year life)	**$13.1/kg**	**$12.8/kg**	**$12.6/kg**	

1. Sourced from Hydrogen vehicle refuelling infrastructure: priorities and opportunities for Australia (CSIRO/GHD, 2023)

Financial Evaluation of Business Case – Hydrogen Demand

H2 Demand in Hay is expected to stabilise at approximately 6,000 kg/d in 2050. Proponents have the option of progressively phasing or investing in upfront HRS capacity to meet demand.



- Hydrogen Demand in Hay is expected to be driven by a combination of accelerated market participation of FCEV vehicles*, and increasing supply from competing HRS's within proximity of Hay**.
- From 2030 to 2040, the demand is expected to accelerate rapidly from market participation before stabilising beyond 2040 as local supply meets demand.
- As market demand increases, the Proponent will likely be required to expand the existing site and develop new sites as demand exceeds the existing hydrogen production capacity.

**2% FCEV Market Participation in 2030, 43% FCEV Market Participation in 2050*
*** 100% capture of market in Hay in 2030, 33% capture of market in Hay in 2050*

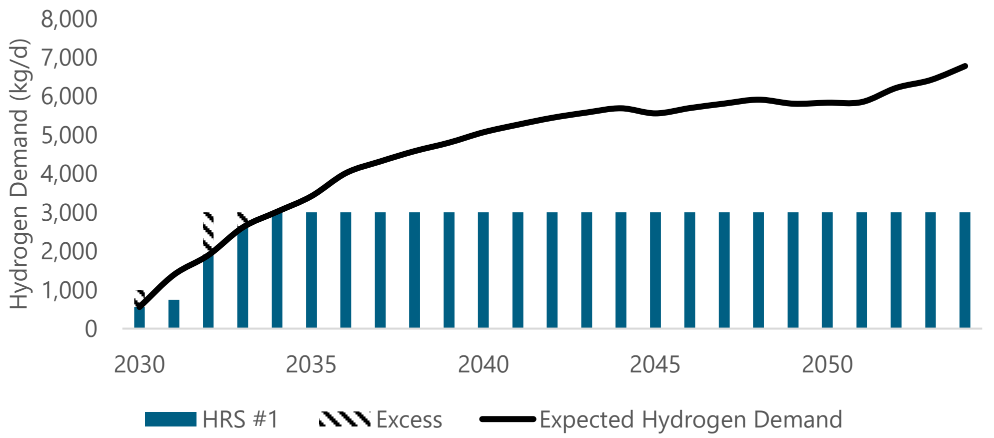
Scenarios	Phased Investment	Upfront Investment
Single Site (Undercapacity)	**Proponent progressively phases investment to maximum capacity for a single site:** • Start with Medium (1000kg/d) • Expand to XL (3000kg/d)	**Proponent makes upfront investment in maximum capacity for a single site:** • Start with XL (3000kg/d)
Multiple Site (At Capacity)	**Proponent progressively phases investment capacity to meet expected demand:** • Start with single site Medium (1000kg/d) • Expand to multiple site XL (3000kg/d) within demand constraints	**Proponent makes upfront investment in maximum capacity for a single site:** • Start with single site XL (3000kg/d) • Expand to multiple site XL (3000kg/d) within demand constraints

For the purposes of the evaluation, expansion has been considered in two scenarios:
- **Phased development** – the Proponent progressively phases capacity to meet the hydrogen demand.
- **Upfront development** – the Proponent builds in excess production from operation start and expands when excess meets demand.

HRS Financial Evaluation – Phased Development Scenario

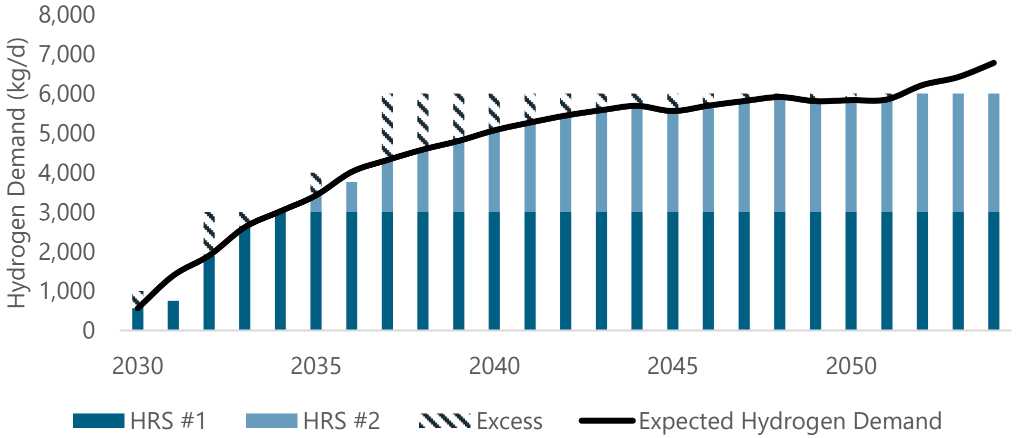
Phased Development considers a gradual investment in capacity with expansion from a Medium to an Extra-large HRS on a Single and Multiple Site basis.

Scenario 1A: Single Site - Phased Investment ("Undercapacity")



2030	2032
• Medium HRS (HRS #1) begins operation in 2030 with a hydrogen production capacity of 1,000 kg/d. • Downtime assumption of 75% of capacity in preceding expansion	• As demand begins to exceed production capacity, HRS #1 is expanded to maximum size of Extra Large HRS producing 3,000 kg/d. • During expansion, HRS #1 is assumed to operate at 75% production capacity (ie. 2030).

Scenario 1B: Multiple Site - Phased Investment ("At Capacity")

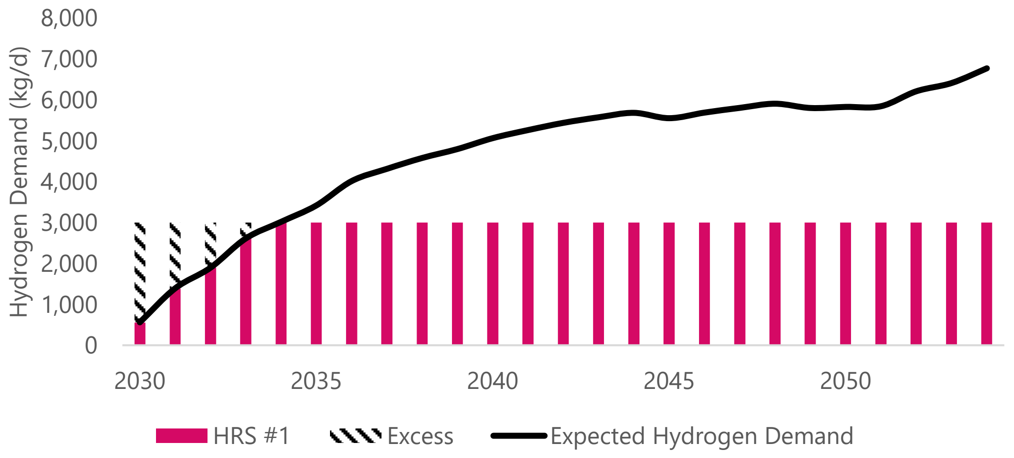


2030 – 2032	2035 – 2037
• Site 1 begins with Medium HRS (HRS #1) in 2030 with a hydrogen production capacity of 1,000 kg/d. • This is expanded to an Extra Large HRS in 2032 for a total production rate of 3,000 kg/d. • Downtime assumption of 75% of capacity in preceding expansion	• Site 2 is brought online as demand exceeds Site 1 capacity. • Phased Investment operates Medium HRS (HRS #2) in 2035 for total production rate of both sites at 4,000 kg/d. • This is later expanded to an Extra Large HRS in 2037 for a total production rate of 6,000 kg/d.

HRS Financial Evaluation – Upfront Investment Scenario

Upfront Investment considers an single investment in a Extra-large HRS on a Single and Multiple Site basis.

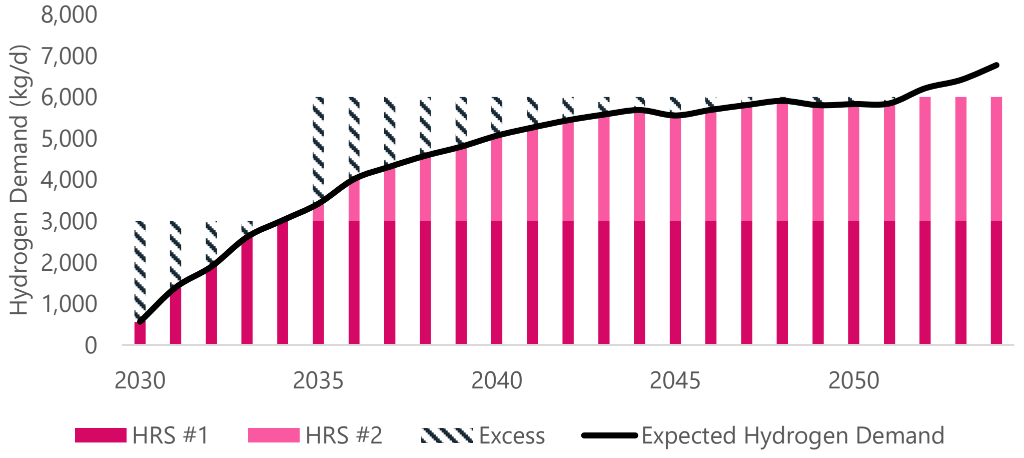
Scenario 2A: Single Site - Upfront Investment ("Undercapacity")



2030

- Upfront investment in to maximum size of Extra Large HRS in 2030. HRS #1 beings operation in 2030 with a hydrogen production capacity of 3,000 kg/d.
- Single site scenario see's no further investment into other additional sites.

Scenario 2B: Multiple Site - Upfront Investment ("At Capacity")



2030

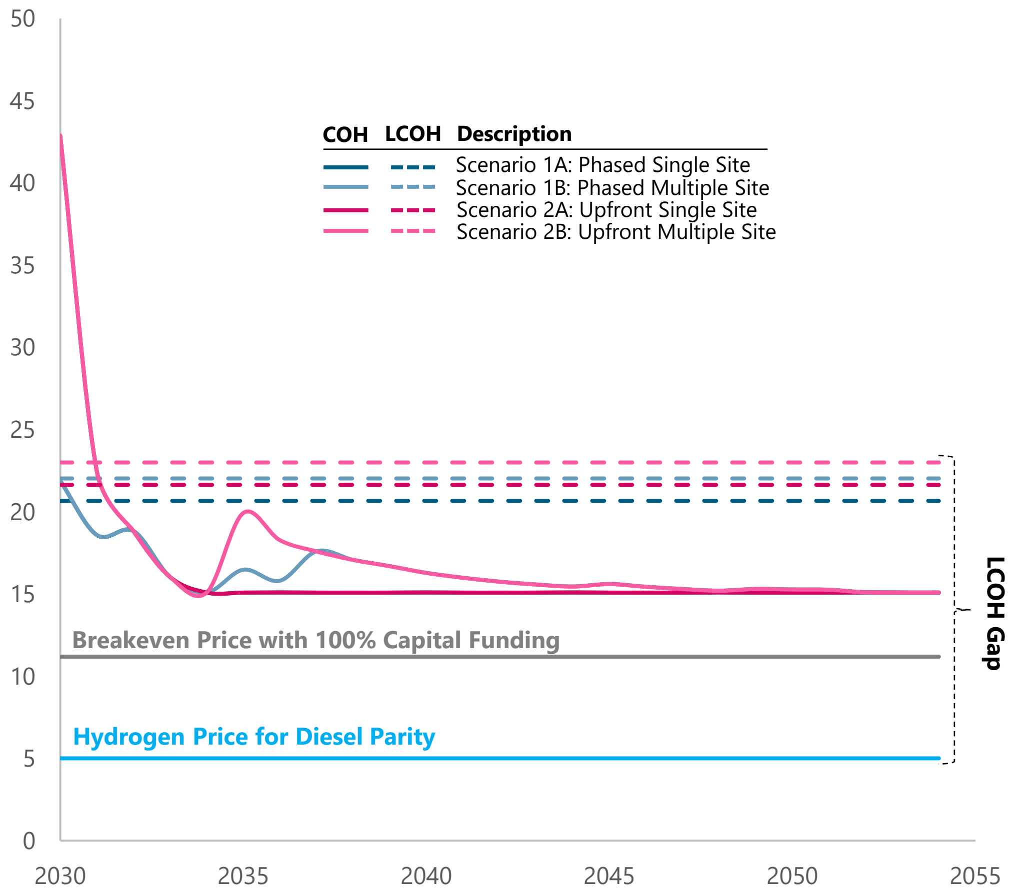
- Upfront investment see's maximum size of Extra Large HRS for Site 1 brought online in 2030. HRS #1 beings operation in 2030 with a hydrogen production capacity of 3,000 kg/d.

2035

- Next upfront investment made in 2035 as demand exceeds the existing Site 1 production capacity.
- The total sum of hydrogen production for both sites would be 6,000 kg/d beyond 2035.

HRS Financial Evaluation – Levelised Cost of Hydrogen (LCOH*)

The evaluation determined that all HRS scenario's require capital funding and operational subsidies to breakeven. Scenario 1A requires the least capital subsidy and lowest operation subsidy.



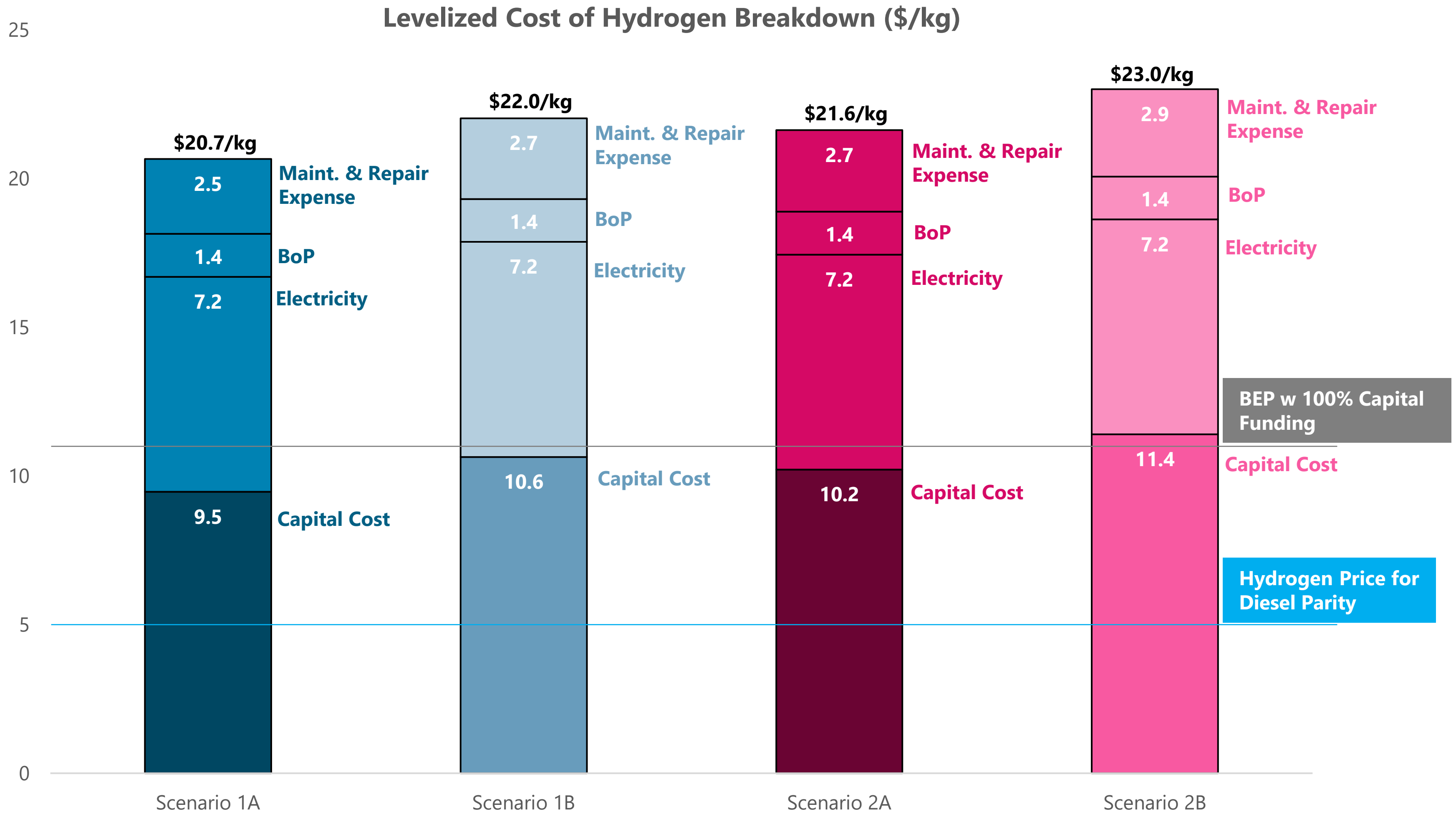
Global Assumptions	
Discount Rate	7%
Operational Period Assessed	2030 to 2054 (25 years)
Operational Days Per Year	360 days per year (~98% utilization)
Tax Rate	30%
Inflation	Not Considered (Real)

Scenario	1A		1B		2A	2B
	2030	2032	2035	2037	2030	2035
Site #1 HRS Size	M	XL	XL	XL	XL	XL
Site #2 HRS Size	-	-	M	XL	-	XL
LCOH Gap						
LCOH	$22.2/kg	$20.7/kg	$21.2/kg	$22.0/kg	$21.6/kg	$23.0/kg
Hydrogen Price for Diesel Parity	$5/kg					
LCOH Gap	$17.2/kg	$15.7/kg	$15.2/kg	$17.0/kg	$16.6/kg	$18.0/kg
Funding Requirements						
Portion of Capital Cost Funded	100%					
Total Capital Funding Required	$42.7m	$110.4m	$153.1m	$210.8m	$110.4m	$220.8m
Breakeven H2 Price (with Capital Funding)	$11.5/kg	$11.2/kg	$11.3/kg	$11.4/kg	$11.4/kg	$11.6/kg
Operating Subsidy at $5/kg of H2	$6.5/kg	$6.2/kg	$6.3/kg	$6.4/kg	$6.4/kg	$6.6/kg

**Levelized Cost of Hydrogen (LCOH) represents the current costs of hydrogen production considering the forecasted capital investment phasing and operating costs.*

HRS Financial Evaluation – LCOH build-up

On a Levelized Cost of Hydrogen (LCOH)* basis, all scenario's are significantly above the $5/kg.

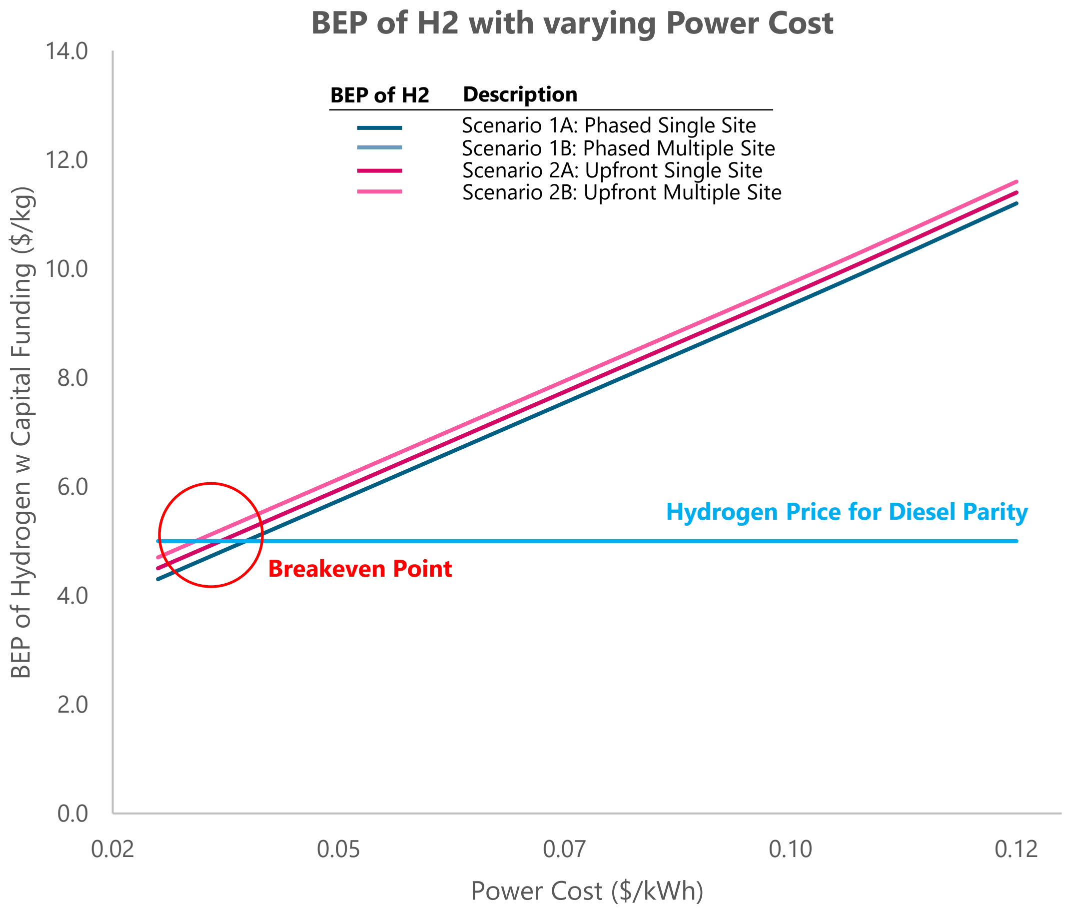


- Capital Cost (on a levelized basis) drives the difference between each scenario, where Scenario 1A has the lowest LCOH due to its lowest Levelized Capital Cost.
- Considering a $5/kg hydrogen price necessary for diesel price parity, breakeven will likely involve a combination of 100% capital funding and an operational subsidy.
- This is due to the significant cost drivers of capital investment and electricity cost, which represent ~70% of the total LCOH across all scenarios.
- Assuming a 100% capital funding scenario, the BEP for all scenarios was calculated at ~$11/kg, which is still higher than the target $5/kg price due to the electricity costs. Subsequently, an additional ~$6/kg operational is also necessary to achieve the $5/kg target.

**Levelized Cost of Hydrogen (LCOH) represents the current costs of hydrogen production considering the forecasted capital investment phasing and operating costs.*

HRS Financial Evaluation – Power Price Sensitivity

In place of an operational subsidy, a power price of ~$0.03/kWh will lower BEP of Hydrogen below the $5/kg target.



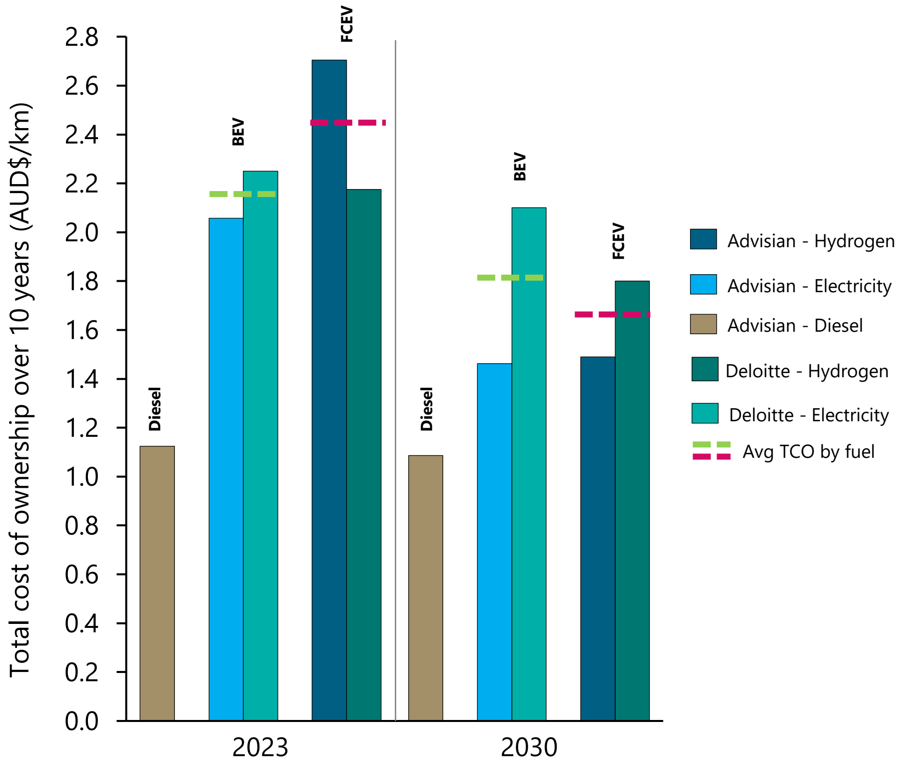
Power Price Sensitivity						
Power Price ($/kWh)		$0.12/kWh	$0.1/kWh	$0.075/kWh	$0.05/kWh	$0.025/kWh
BEP of Hydrogen w Capital Funding ($/kg)	1A	11.2	9.7	7.9	6.1	4.3
	1B	11.4	9.9	8.1	6.3	4.5
	2A	11.4	9.9	8.1	6.3	4.5
	2B	11.6	10.1	8.3	6.5	4.7

Base Case | Above Breakeven | Below Breakeven

- In place of a ~$6/kg operational subsidy, a sensitivity analysis on power price was performed to see the required power price to achieve a BEP of Hydrogen below the $5/kg target.
- The sensitivity analysis indicated that a ~$0.03/kWh or $30/MWh power price would be necessary. This represents ~25% of the assumed $0.12/kWh wholesale renewable electricity price.

HRS Financial Evaluation – TCO Parity with ICE

The lessor is expected to be able to lease its FCEV trucks at a price equivalent to ICE TCO with 20% green premium.



- TCO for a FCEV and Diesel truck is expected to be ~$1.8/km and ~$1.1/km over 10 years by 2030, respectively.
- The total TCO gap between a FCEV and Diesel truck is expected to be $0.7/km in 2030.

Truck Lease Assumptions

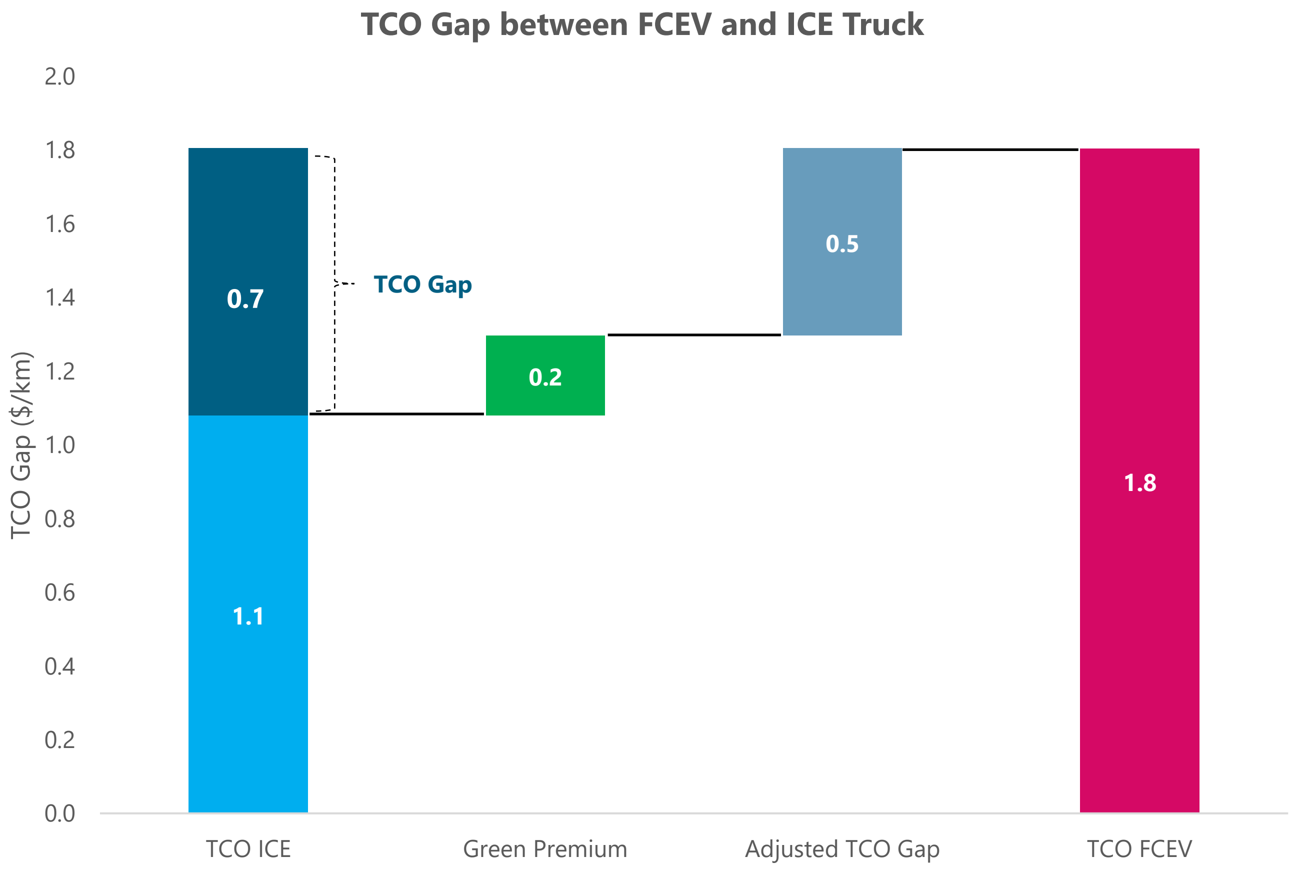
		Assumptions	FCEV
Revenue	Lease Terms	ICE Truck TCO	$1.1/km
		Green Premium	20%
		FCEV Lease Price (ICE TCO w 20% Green Premium)	**$1.3/km**
		Lease Period	10 years
Operating /Capital Cost	Total Cost of Ownership	FCEV Truck TCO	$1.8/km

- Lease Price to the lessee for an FCEV truck has been assumed to be the 10 year TCO of an equivalent diesel truck ($1.1/km) with an additional 20% green premium. Subsequently, the assumed rate for a 10 year FCEV truck lease is $1.3/km.
- Given a $1.8/km TCO for a FCEV truck, the adjusted TCO gap (ie. funding required to breakeven) is expected to be $0.5/km.

1. Fuel cells and hydrogen applications for regions and cities volume 2 – Cost analysis and high level business case. Roland Berger 2017, Fuel Cell Hydrogen Trucks 2020
2. Fuelling the future of mobility – Hydrogen and fuel cell solutions for transportation – Volume 1 Deloitte China 2020

Financial Evaluation – TCO Gap for Truck Lease

An Adjusted TCO Gap of $0.5/km is worth approximately 30% or $189k of Capital Funding for every FCEV Heavy Haulage Truck worth $650k.



Truck Lease	
TCO Gap	
ICE TCO	$1.1/km
FCEV Lease Price (ICE TCO w 20% Green Premium)	$1.3/km
FCEV TCO	$1.8/km
Total TCO Gap (FCEV – ICE)	**$0.7/km**
Adjusted TCO Gap (FCEV TCO – FCEV Lease Price)	**$0.5/km**
Funding Requirements	
FCEV Heavy Haulage Truck Purchase Price*	$650,000
Portion of FCEV Funded to Breakeven	30%
Capital Funding Required Per Truck	**$189,368**

- Assuming a FCEV Heavy Haulage Truck Price of $650k, the adjusted TCO gap of $0.5/km is equivalent to $189k in capital funding per truck.

1. Fuelling the future of mobility – Hydrogen and fuel cell solutions for transportation – Volume 1 Deloitte China 2020

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HRS Design Overview

Design principles

Two designs have been proposed to ensure flexibility across locations and end-use application.

	Layout Option	
	Medium	***Extra Large***
Refuelling capacity (trucks/day)*	9 heavy rigid vehicles, 70 kg in 30 minute fill 2 articulated vehicles, 105 kg in 40 minute fill	23 heavy rigid vehicles, 85 kg in 35 minute fill 6 articulated vehicles, 105 kg in 40 minute fill
Service station & utilities	• Convenience store • Parking for heavy vehicles • Air and water utilities	• Convenience store • Parking for heavy vehicles • Air and water utilities
Total site area footprint	4544 m^2	6944 m^2
H2 Source/Supply	On-site electrolysis	On-site electrolysis
Storage capacity	12 x MP storage tubes (720 kg H_2 @ 500 bar) 12 x HP storage tubes (600 kg H_2 @ 900 bar)	36 x MP storage tubes (2,160 kg H_2 @ 500 bar) 36 x HP storage tubes (1,800 kg H_2 @ 900 bar)
Dispensing pressure	Heavy rigid vehicles - 350 bar and 700 barg Articulated vehicles – 700 barg	Heavy rigid vehicles - 350 bar and 700 barg Articulated vehicles – 700 barg
Compressor max. throughput (Nm^3/h)	52 kg/h	156 kg/h
Hydrogen production nominal capacity	1,000 kg/day	3,000 kg/day
Electrolyser Size	2.5 MW	7.5 MW (3 x 2.5 MW)
Hydrogen flow rate	44 kg/hr	132 kg/hr
Number of dispensers	2 (Dual pressure)	6 (Dual pressure)

Design principles (continued)

Each design and layout configuration has been developed according to select performance requirements.

		Parameter	
Electrolyser			Unit
Efficiency	**(Stack, BOL) max**	48	kWh/kg H2
	(System, BOL) max	54	kWh/kg H2
Stack replacement life (min)		80,000	hours
Stack efficiency degradation (max)		1%	per year / 8,000 hr
Turndown operation (min)		5	%
Output Pressure (min)		30	barg
Turn-on time from Standby		<10	seconds
Initiation time (Black start)		<10	mins
Hydrogen purity after de-oxo dryer: *To comply with ISO 14687-2019*		>99.97% H2 <5ppmv O2 <5ppmv H2O	
Water input (max)		16	kg H2O / kg H2
Hydrogen Refuelling Station			
Dispensing pressure	**Light vehicle**	700	barg
	Heavy vehicle	350 or 700	barg
Refuelling time	**Car (5 kg @ 700 bar)**	<5	minutes
	Heavy vehicle (35 kg @ 350 bar)	15	minutes
	Heavy vehicle (70 - 105 kg @ 700 bar)	30 - 40	minutes
Compressor capacity (min) (per compressor, 2-6 compressors will be required to meet demand)		26	kg/h
Dispensing rate		Max 60 g/s in accordance with SAE J2601 protocol	
Minimum suction pressure		10	barg

Refuelling facility layout – Design philosophy

A number of safety, regulatory and operability considerations have been incorporated into the design of the facility.

General design considerations

The proposed hydrogen plant layout incorporates indicative layouts and footprints for each equipment package and takes into account typical separation distances required for hydrogen units and storage. The below considerations outline the basis for the proposed layout, with further assessment to be completed in the next design phase.

All equipment should be situated outdoors where possible to ensure that there is no potential for accumulation of hydrogen. It is expected that containerised, pre-fabricated and assembled equipment packages will be utilised wherever possible.

The following main items were considered in the plant layout design:

- Boundary separation distances / site boundary / future expansions
- Process blocks/area allocations / separations
- Maintenance requirement access and clearances
- Hazardous Areas classification
- Storage capacity and location
- Traffic/truck refuelling
- Fire protection, emergency response access/egress.

The layout of a hydrogen fuelling station shall reduce to an acceptable level the likelihood of damage or injury from activities carried out on the fuelling station, or external to the fuelling station property. This may include hazards from fires of stored fuel or other combustibles, including buildings, on or in the vicinity to the fuelling station, damage from impact of moving equipment/vehicles, or environmental hazards such as falling trees.

The following elements of a hydrogen fuelling station are considered potential hazard sources:

- On-site hydrogen production unit
- Piping connections (non-welded)
- Compressors and storage
- Dispensers.

The layout design of the gaseous hydrogen buffer storage vessels and piping shall consider the risk from direct impingement of jet flames from potential leak points or vents onto an adjacent vessel. Installations should be kept free of vegetation debris and other flammable materials.

Safety and operability

The layout considered the following key safety and operability factors to support a flexible and safe site:

- Adequate spacing and separation distances between plant facilities allowing for major hazard incidents, constructability, maintenance access, and isolation
- Oxygen and hydrogen vent designs and positioning to be considered carefully to allow for good dispersion of gases, and to be positioned at an adequate distance from any potential ignition sources
- Access for emergency services
- Appropriate road surface finishes to manage storm water run-off, traffic movements and accessibility during weather events
- Separate controlled access to the main process plant area via fenced and secured gates

Refuelling facility layout – Design philosophy (continued)

The hydrogen fuelling station layout shall incorporate adequate safety distances.

Safety distances

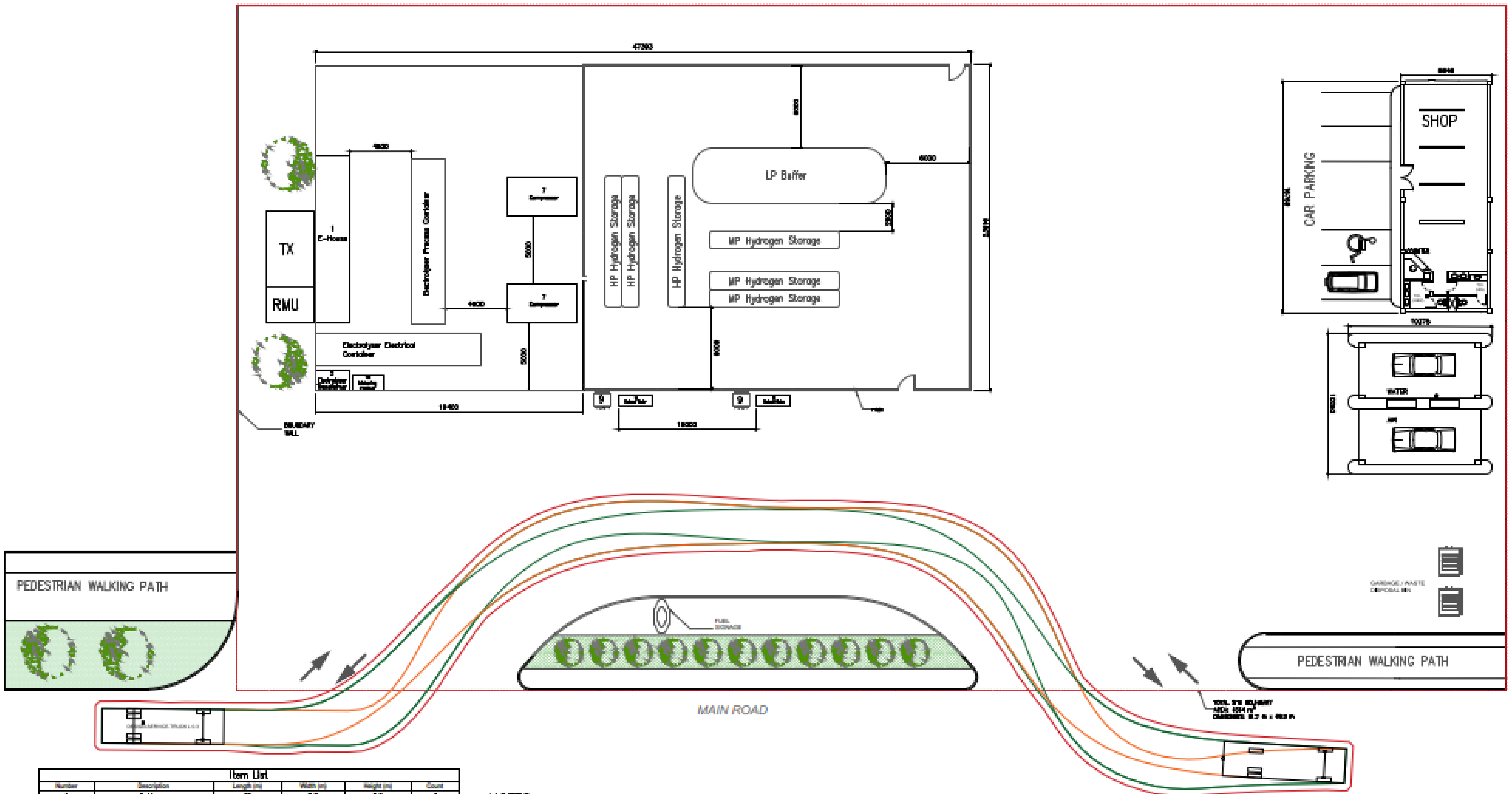
The hydrogen fuelling station layout will incorporate adequate safety distances. The safety distance is the distance to an acceptable risk level or the minimum risk-informed separation between a hazard source and an object (human, equipment, or environment) that will mitigate the effect of a likely foreseeable incident and prevent a minor incident from escalating into a larger incident (considering all mitigation and safety measures implemented). This includes effects from hazard sources beyond the boundaries of the fuelling station.

In various regulations and industrial practices, the term "safety distance" often includes many types of distances, such as: protection distances, clearance distances, installation lay-out distances, distances to external risk sources, and distances within which restrictions apply. For standard equipment and events, safety distances can be prescribed by national regulations, and/ or may be determined through quantitative risk assessment of a generic design. For any given fuelling station, one may also conduct a quantitative risk assessment, which can be used to understand the risks and the effects of station-specific mitigations; the result of the analysis may result in a recalculation of the safety distance to result in station-specific safety distances. If the safety distance is too large, additional mitigation or prevention measures should be considered and the safety distances may be re-calculated using a quantitative analysis.

Definitions of Types of Safety Distances according to ISO 19880-1:2020

Category	Purpose	Source	Target (s)
Restriction distances	Minimize risk in areas adjacent to hydrogen Equipment	Fuelling station equipment	Any open area adjacent to hydrogen equipment
Clearance distance	Protect persons and objects within the establishment from hazards associated with the fuelling station	Equipment and objects within fuelling station	Persons and other facilities within the establishment
Installation layout distance	Prevent escalation of events within fuelling installation	Fuelling station equipment	Fuelling station equipment
Protection distance	Protect the fuelling station from damage due to any external hazards	Off-site facilities and on-site things (except for the fuelling station equipment)	Fuelling station equipment
External risk zone	Mitigate off-site risks from hazards associated with the fuelling station	Fuelling station equipment	Surrounding people/property outside of the establishment

Medium HRS facility layout

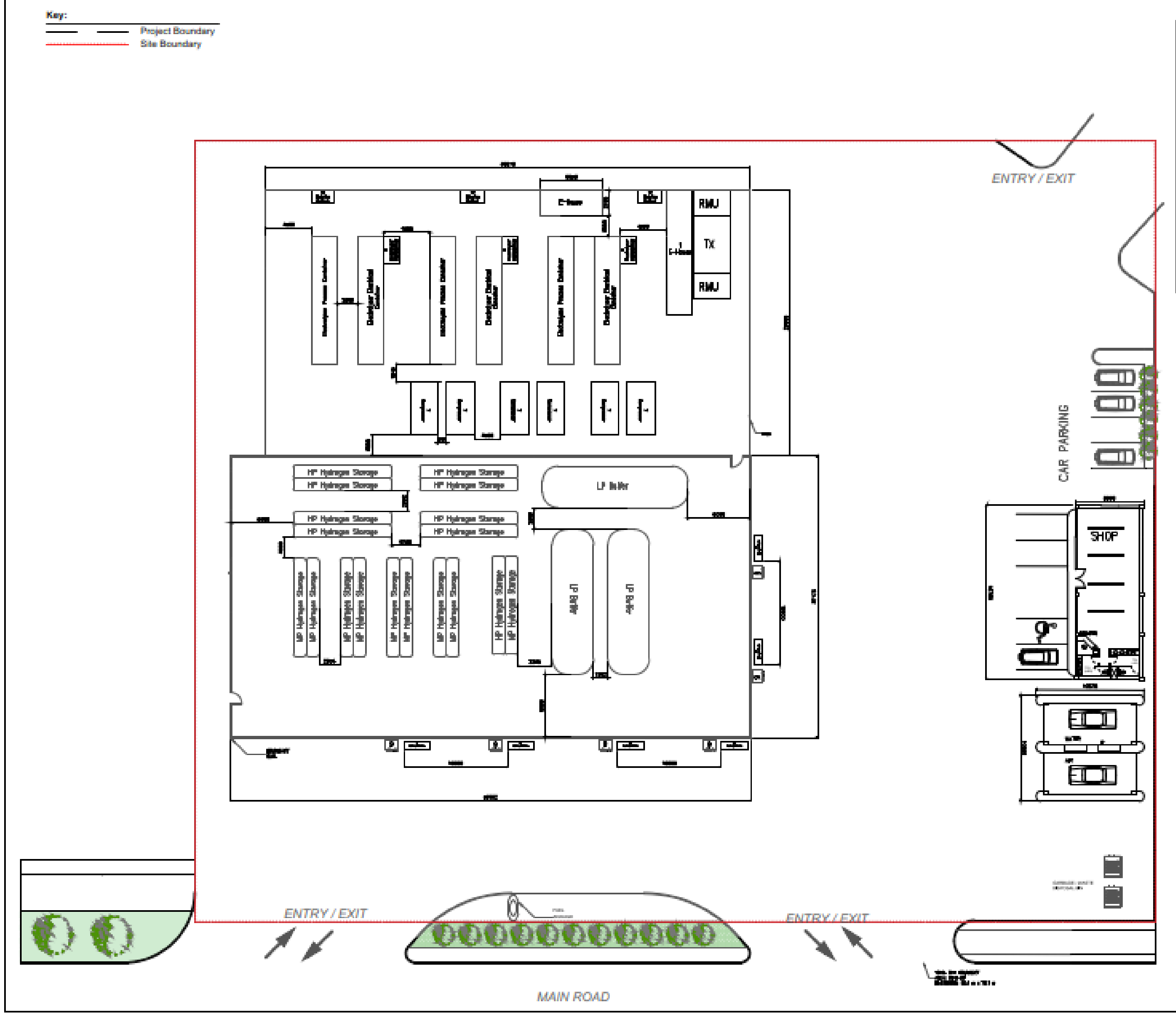


Item List					
Number	Description	Length (m)	Width (m)	Height (m)	Count
1	E-House	12	2.5	2.9	1
2	Electrolyser Transformer	2.50	1.6	2.6	1
3	Electrolyser Process Container	12	2.4	1.6	1
4	Electrolyser Electrical Container	12	2.4	2.9	1
6	LP Buffer	10	2.5		1
7	Compressor	5	2.7	2.6	2
8	HP Hydrogen Storage	9.4	1.30		3
9	Hydrogen dispenser	1.1	0.6	2.6	2
10	Metering cabinet	2.3	1.2		1
11	Hydrogen cooler	2.5	0.8		2
TX	Utility supply transformer	5.5	3.5		1
RMU	Ring main unit	2.5	3.5		1
	MP Hydrogen Storage	8.40	1.20		3

NOTES:
1. All dimensions in mm.
2. Item 5 (electrolyser rectifier) to be near item 4 (electrolyser package).
3. 6m clearance from storage to boundary.
4. 4.5 m clearance from long side of electrolyser container.
5. 5m clearance from long side of compressor container.
6. E–house (item 1) near the RMU and TX.
7. RMU = Ring Main Unit
8. TX = Utility supply transformer

Key:
Project Boundary
Site Boundary

Extra Large HRS facility layout
Medium HRS facility layout



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5	LP Buffer	10	2.5		3
7	Compressor	5	2.7	2.6	6
8	MP Hydrogen Storage	9.4	1.20		9
9	Hydrogen dispenser	1.1	0.6	2.5	6
10	Metering cabinet	2.3	1.2		3
11	Hydrogen cooler	2.5	0.8		6
TX	Utility supply transformer	5.5	3.5		3
RMU	Ring main unit	2.5	3.5		3
	HP Hydrogen storage	9.40	1.20		3

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7. RMU = Ring Main Unit
8. TX = Utility supply transformer

HRS List of items

Typical dimensions of individual assets that build up the HRS are tabulated along with their count.

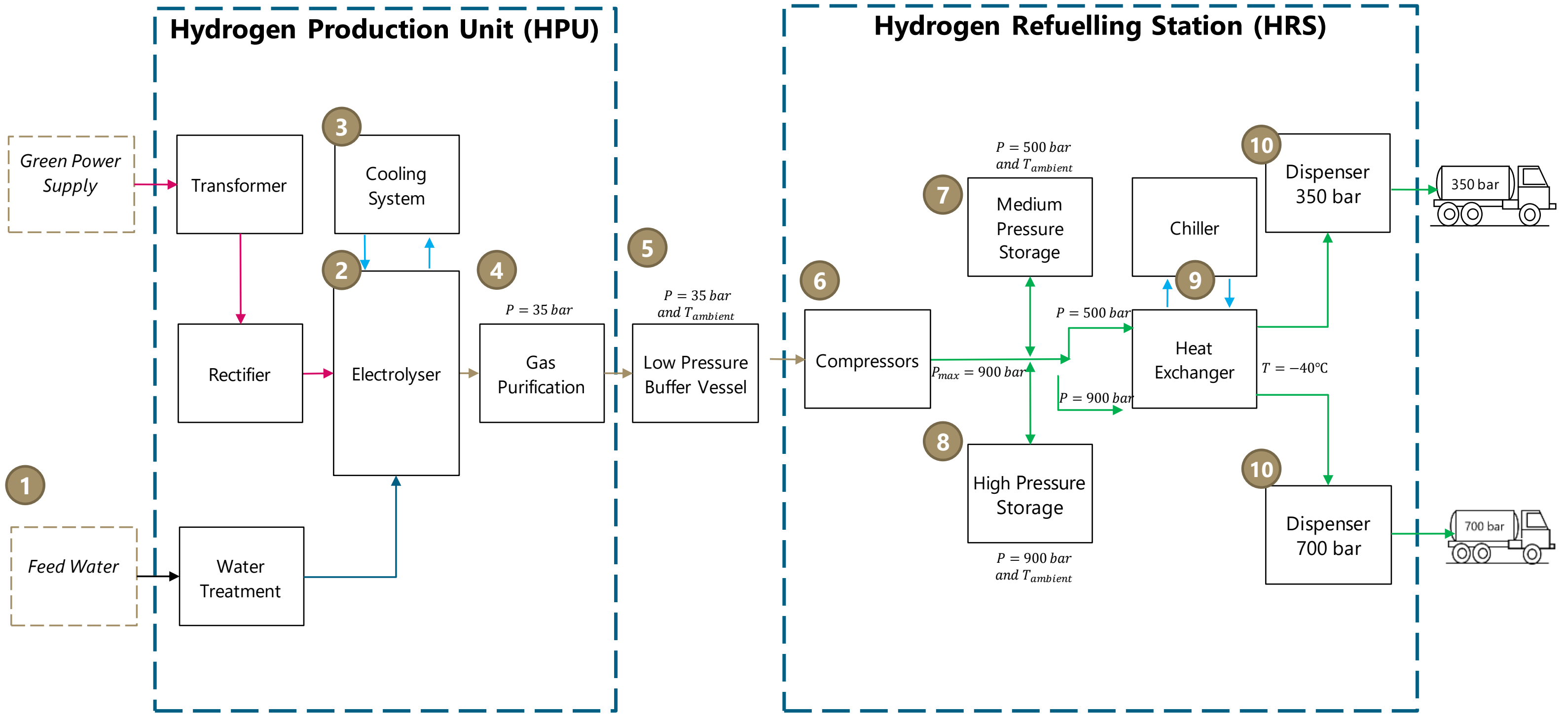
No.	Description	Count	
		2030 (Medium)	2050 (X Large)
1	E-House	1	1
2	Electrolyser Transformer	1	3
3	Electrolyser cooler	1	3
4	Electrolyser package (including water treatment and separators)	1	3
5	Electrolyser Rectifier (power control module)	1	3
6	LP Buffer	1	3
7	Compressor	2	6
8	MP Hydrogen storage	1	3
9	HP Storage	1	3
10	Hydrogen dispenser	2	6
11	Metering Cabinet	1	1
12	Hydrogen Cooler	1	6
13	TX - Utility Supply transformer	1	1
14	RMU - Ring Main Unit	1	2
15	Valve Panel for compressors	1	1

Functional specifications

Process Flow Diagram

A typical hydrogen refuelling facility consists of two main systems hydrogen production unit (HPU) and a hydrogen refuelling station (HRS).

Overview of typical hydrogen refuelling facility



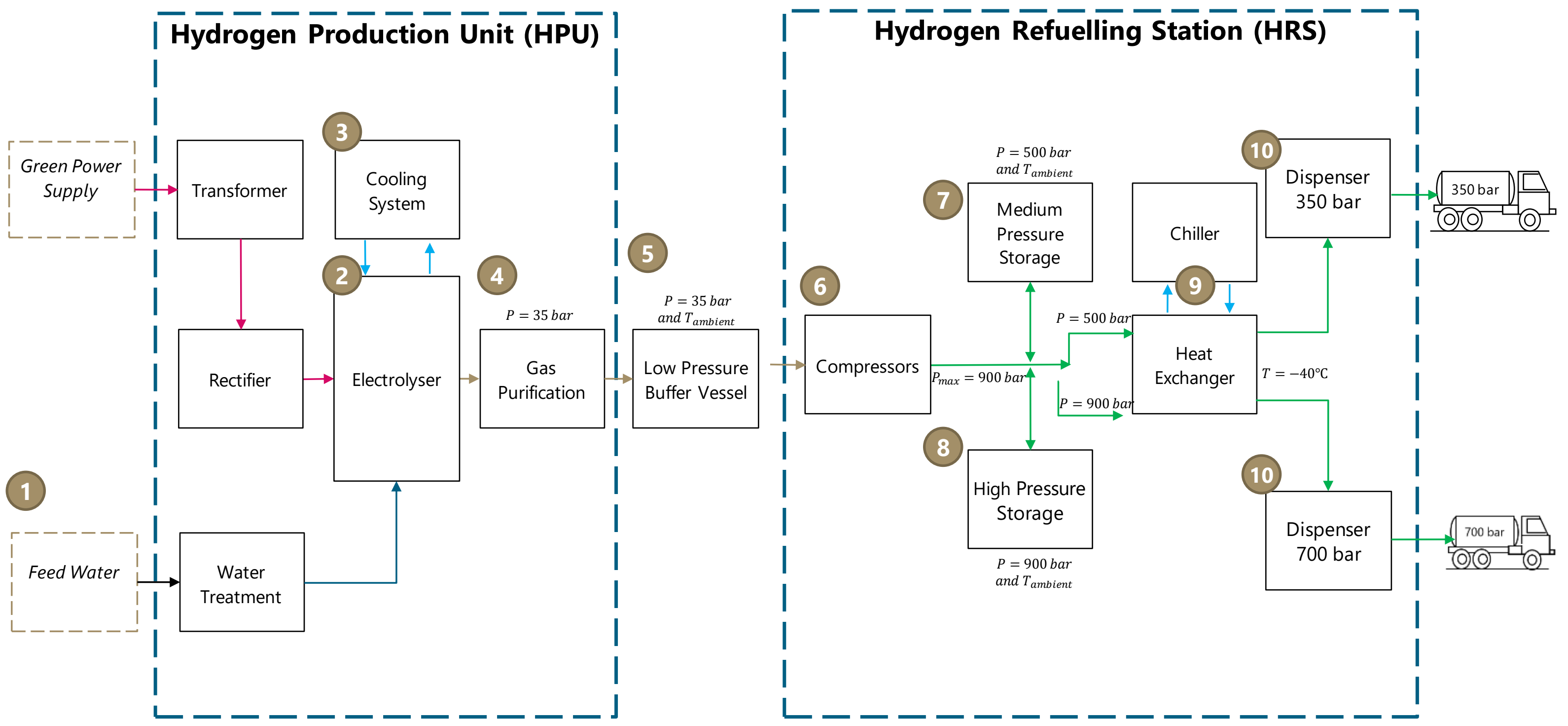
Summary - HPU

1. **Feed water treatment** Water treatment uses mains/town water and supply ultrapure water to the electrolyser stack
2. **Electrolyser** Many different types of electrolyser are currently available, with varying levels of technology maturity and associated advantages and disadvantages.
3. **Cooling system** The electrolyser cooler is generally supplied as part of the electrolyser package and dissipates the heat generated from the electrolysis process
4. **Gas purification** Typical impurities from a PEM electrolyser, which must be removed prior to compression and storage
5. **Low pressure storage** Buffer storage is generally required between the electrolyser output and the refuelling station compressor suction

Process Flow Diagram

A typical hydrogen refuelling facility consists of two main systems hydrogen production unit (HPU) and a hydrogen refuelling station (HRS).

Overview of typical hydrogen refuelling facility



Summary - HRS

6. **Compression** Hydrogen compressors are typically positive displacement type compressors, either piston or diaphragm. The number of compressors is dependent on compressor type, suction pressure and required discharge pressure (i.e. vehicle fill pressure)
7. **Medium pressure storage** Medium pressure (MP) storage, which is typically 500 bar is used when refuelling station is only fuelling vehicles to 350 bar.
8. **High pressure storage** If the refuelling station is required to refuel vehicles to 700 bar, then 900 bar high pressure (HP) storage is required.
9. **Chiller & heat exchanger** Cooling system helps to achieve fasting refuelling rate. A common protocol is to cool the hydrogen down to -40°C.
10. **Dispenser** The dispenser at a public fuelling station for light duty vehicles is designed with separate nozzles to fuel vehicles to 350 bar and/or 700 bar nominal pressures.

Functional Requirements & Basis

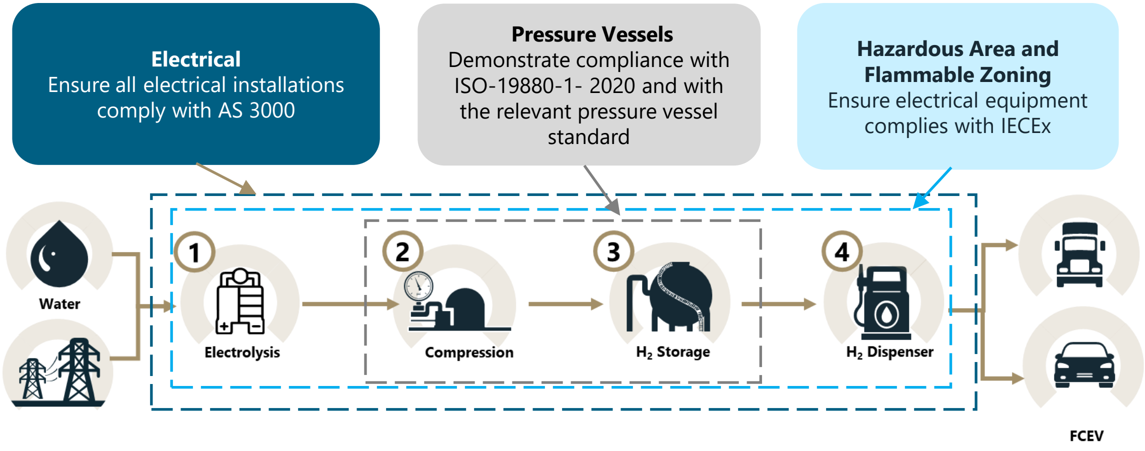
Adhering to Australian Standards - Overview

Australian Standards specifically governing the development of hydrogen refuelling facilities are currently under development.

Overview of applicable Australian Standards

- At present there is no overarching safety framework or standard governing the development of hydrogen refuelling facilities in Australia. Existing HRSs have instead been built to a number of existing International Standards.
- To support the development of the mobility sector, the Australian Hydrogen Technologies Standards committee (ME-093), has adopted a subset of ISO standards specific to hydrogen refuelling stations.
- Despite the lack of complete framework, there are a number of **specific standards and requirements that must be adhered to** in the development of HRS solutions in Australia across electrical, pressure vessels and hazards areas and flammable zoning.

Australian Standards relevant for hydrogen refuelling facilities.



Adopted Australian Standards relevant for HRS development

Aus. Standard	Scope
AS 22734	Hydrogen generators using water electrolysis – Industrial, commercial, and residential applications
AS 16110.1	Hydrogen generators using fuel processing technologies
AS ISO 16110.2	Hydrogen generators using fuel processing technologies
SA TS 19883	Safety of pressure swing adsorption systems for hydrogen separation and purification
AS ISO 16111	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride
AS ISO 19881	Gaseous hydrogen – Land vehicle fuel containers
AS ISO 19880.3	Gaseous hydrogen – Fuelling stations
AS 26142	Hydrogen detection apparatus – stationary applications
AS ISO 14687	Hydrogen fuel quality – Product specification
AS ISO / TR 15916	Basic considerations for the safety of hydrogen systems
AS ISO 19880.5	Gaseous hydrogen — Fuelling stations, Part 8: Fuel quality control
AS ISO 19880.8	Gaseous hydrogen - Fuelling stations, Part 5: Dispenser hoses and hose assemblies

Summary of International HRS standards

In the absence of dedicated Australian Standards, International Standards have been used as a reference to guide the development of hydrogen refuelling facilities.

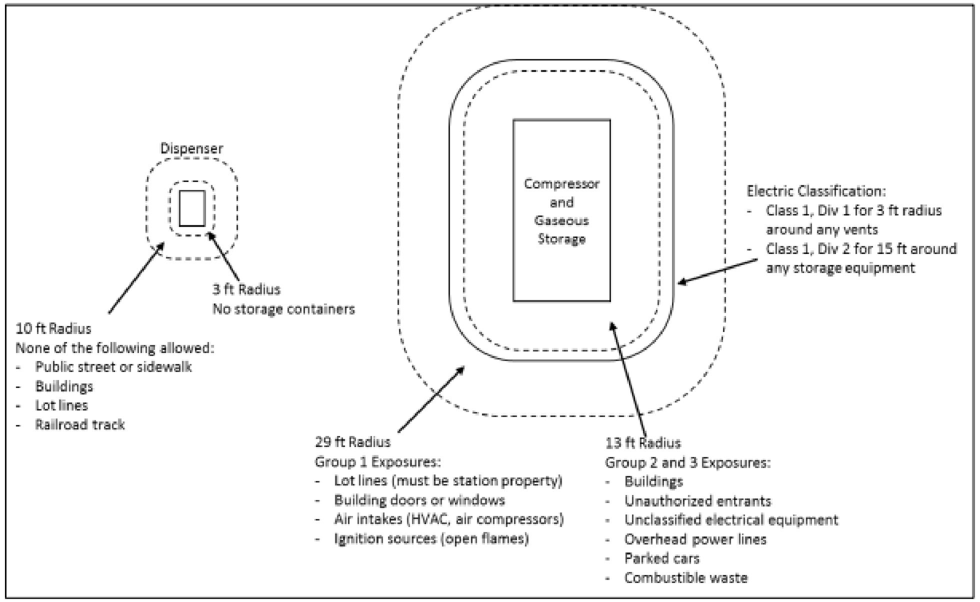
Overview of the application of International Standards

- A number of International Standards exist for hydrogen refuelling stations as developed by the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), and International Telecommunications Union (ITU).
- However, not all of these standards have been adopted in Australia.
- Internationals Standards provide guidance on the development of refuelling facilities, but care should be taken in their application to ensure that they meet the desired safety outcomes.

Applicable International Standards to hydrogen refuelling development.

Standard	Description
ISO 19880 series	International Standards Organisation (ISO) Technical Committee (TC) 197, has been tasked with the development of the ISO 19880 series which aims to define the minimum requirements applicable for the safety and performance of gaseous hydrogen stations.
SAE J2601 series	SAE J2601 (along with J2799) provides guidance on the fuelling hydrogen storage systems to a high state of charge (SOC) without violating the operating limits of the internal tank temperature or pressure.
SAE J2799 series	The intent of SAEJ2799 is to enable the harmonised development and implementation of hydrogen fuelling interfaces for Fuel Cell Electric Vehicles (FCEVs)
NFPA 2	NFPA 2 provides fundamental safeguards for the generation, installation, storage, piping, use, and handling of hydrogen in compressed gas (GH2) form or cryogenic liquid (LH2) form.

Separation distances for 350 Bar hydrogen equipment provided by NFPA 2 Hydrogen Technologies Code: 2020



Lessons learnt from previous HRS developments in Australia

Previous hydrogen refuelling projects have had to modify internationally sourced equipment to adhere to three critical Australian requirements.

Area	Key requirements	Implication for design
Electrical	• All electrical equipment must comply with AS 3000 – Wring Rules, which are different to International Standards • The Australian Regulators have advised that packaged equipment should not be treated as 'black-boxes' as they are likely to have their own internal switchboard which needs to follow detailed Australian regulations • If the HRS size is large enough for this to be economic, electrical switchboard equipment could be sourced from Australia to ensure compliance with AS 3000. Some vendors segregate electrical and process equipment packaging to enable this. • Equipment in hazardous areas must be certified through IECex certification system some international vendors use ATEX certification which is not suitable	• Ensure all electrical installations comply with AS 3000
Pressure Vessels	• Design registration and verification is mandatory in Australia and goes above and beyond global requirements which only apply to large pressure vessels. • Electrolysers and HRS equipment often contain a number of small internal pressure vessels so additional costs may be incurred ensure compliance.	• Demonstrate compliance with ISO-19880-1- 2020. • Demonstrate storage and associated facilities comply with the relevant pressure vessel standard. This will typically be AS1210, AS 2030
Hazardous Area and Flammable Zoning	• Australia's hazardous flammable zoning rules that differ from Europe and the US. • Australia operates under the International Electrotechnical Commission (IECex) Scheme for the certification of equipment for explosive atmospheres in Australia, while the European Union has adopted an alternative ATEX certification scheme • Equipment sourced from Europe that carries an ATEX certification is not accepted and would require approval or modification for its use from the appropriate regulatory authority in each state	• Ensure electrical equipment complies with IECEx or ensure equipment is certified to comply with this requirement.

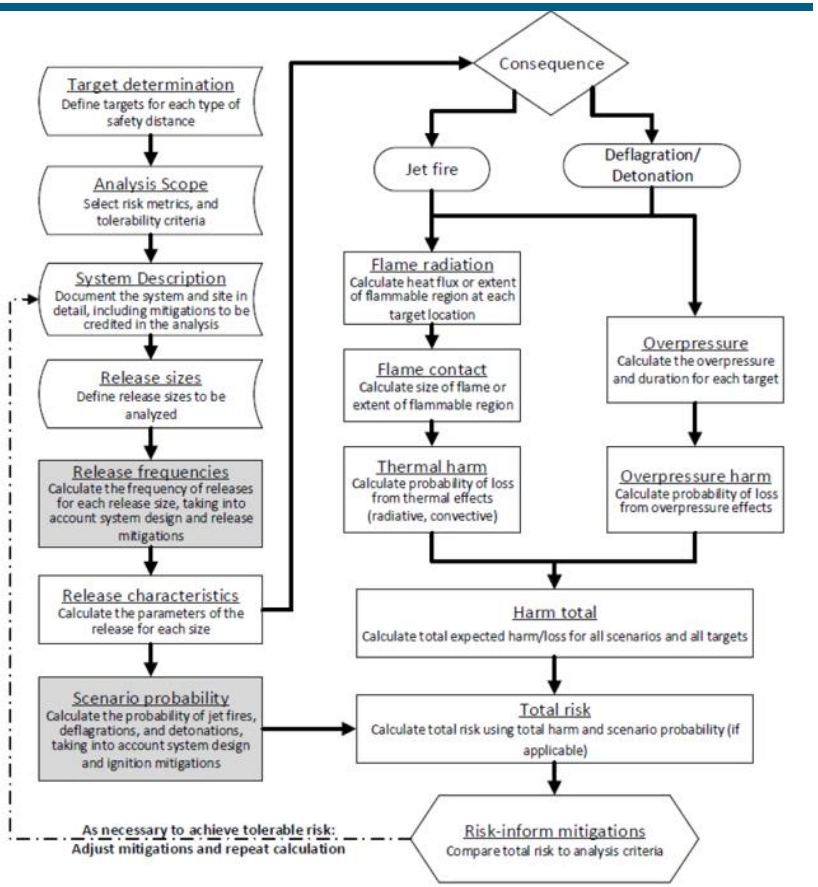
Acceptable safety distances in Australia

Australia operates under a risk based safety approach where it must be shown safety distances are acceptable.

Overview

- There are no Australian Standards for hydrogen safety or separation distances. Australia instead takes a risk-based approach in assessing safety distances based on each state's specific regulations and guidelines.
- Australia's risk based approach is based on planned adoption of **ISO 19880-1:2020** and has just recently completed the public consultant period.
- Separation distances are fundamental to the design of the HRS, with the intent to:
  - Protect people from harmful events
  - Protect buildings, structures and sensitive receptors from damage
  - Prevent escalation (of events) within the facility
- A range of separation distances have been applied globally with guidance provided by the NFPA 2 Hydrogen Technologies Code: 2020. The NFPA 2 contains minimum separation distances required between hydrogen station equipment and surrounding buildings, property limits or boundaries. Separation distances are dependent on the pressure of the stored hydrogen and the size of tubing.

ISO 19880: Example Hydrogen risk-informed approach to safety distances



Acceptable safety distances in Australia

Australia operates under a risk based safety approach where it must be shown safety distances are acceptable.

Overview

- The minimum separation distances required between hydrogen station equipment and surrounding buildings, property limits or boundaries need to be assessed as part of the layouts and HRS siting studies. This will impact the site selection and where the HRS can be located.
- Separation within the HRS, including to any retail spaces needs to be assessed as part of the and layout development and this can impact the space required for the layouts. The required distances varying depending on what is being separated, with the distance to schools & hospitals greater than to industrial facilities.
- Unmitigated these separation distances can be over 100m to neighbouring properties, so various protection measures are required as part of the HRS, including
  - Fire walls
  - Separation distances to retail spaces, neighbouring properties and the wider community
  - Separation of equipment within the HRS
- Further analysis will be required to confirm the site specific separation distances, include a QRA to provide a quantification of the likelihood of the Hazard range exceeding the Plant Boundary but will require agreement with regulators

Generic Risk Contour Distances

Land Use	*Risk Contour (fatalities/annum)*	*Generic Risk Contour distance*
Hospitals, schools, childcare, aged care	5e-07 (1 in 2 million)	~80m
Residential, Tourist, Hotels	1e-06 (1 in 1 million)	~80m
Commercial, Retail, Offices	5e-06 (1 in 200,000)	~60m
Sporting Complexes, Parks, Open spaces	1e-05 (1 in 100,000)	~50m
Industrial	5e-05 (1 in 20,000)	~25m

Location Specific Individual Risk (LSIR) is the risk of fatality to a hypothetical individual being present at a specific location for 365 days per year, 24 hours a day, unprotected and unable to escape.

Hydrogen refuelling facility – Operations & Maintenance

Electrolyser – O&M Summary

A number of O&M considerations need to be incorporated into Electrolyser selection, design and layout, with a supporting documented inspection and maintenance program developed.

Operations

- Daily operation should not require any personnel present, as the control system manages the starting, stopping, ramping and interfaces with ancillary systems.
- Operators will require to perform activities on a weekly or monthly basis. These will include:
    - Visual inspection of the facility, including valves, piping, pressure relief devices and filters
    - Verification of process parameters
    - Calibration of H2 gas sensors
    - Replenishing consumables
    - Functional check of the ventilation and safety systems.
- Warning signs will be required to identify hazards identified in the risk assessment.

Maintenance

- Preventative maintenance activities requiring a full system shutdown are required for approximately 2 days twice a year.
- Typical activities carried out during these shutdowns include:
    - Instrument calibration
    - Function checks
    - Filter inspection/and replacement
    - Oil changes for pumps
    - Glycol quality checks
    - Replenish consumables (calibration gases, water treatment chemicals).
- Stack replacement is generally required after approximately 80,000 hrs of operation, this can be a considerable capital cost (~20% of initial capex).
- Other long term maintenance requirements include:
    - Recertification of relief valves (3 years)
    - Recertification of pressure vessels (3 years)
    - Replacement of high cycling valves (5 years)
    - Replacement of desiccant in H2 dryer (10 years).
- The hydrogen facility must have a documented inspection and maintenance program in place.

Hydrogen refuelling station – O&M Summary

O&M requirements exceed traditional refuelling station requirements and need to be considered in HRS design and layout development.

Operations

- The pressure and temperature after the final stage of compression must be monitored. These and other important parameters will be monitored by the PLC and alarm or trip in any unsafe condition.
- Instructions for use of the hydrogen fuelling station dispenser by the public should be included on or in the vicinity of each dispenser.
- Warning signs will be placed to identify hazards identified in the risk assessment.
- Operators will require to perform some activities on a weekly or monthly basis. These will include:
    - General plant walkaround (Look, listen and feel)
    - Check HMI alarm status
    - Visual inspection to identify corrosion, physical damage, leaks etc.
    - Check fluid levels and pressures such as oil, cooling water
    - Check ventilation systems
    - Lubricate refuelling coupling.

Maintenance

- Routine maintenance checks will be required on a 3-6 monthly basis and may not require a full shutdown. These can include;
    - Functional check of E-stops
    - Leak checks and fluid top-up (oil, cooling water)
    - Pressure adjustments
    - Filter checks
    - Calibration of gas sensors.
- Annual preventative maintenance activities requiring a full system shutdown are required for approximately 2 days once a year. Typical activities carried out during these shutdowns include
    - Compressor valve and seal checks / replacement
    - Filter replacement
    - Hydraulic hose inspection / replacement
    - Instrument calibration
    - Oil change.
- Hoses should be replaced after 2 years of use or immediately after any mechanical abuse such as a breakaway incident. Other long term maintenance requirements include:
    - Recertification / replacement of relief valves
    - Pressure test and recertification of pressure vessels
    - Refuelling coupling replacement
    - Compressor belt replacement.

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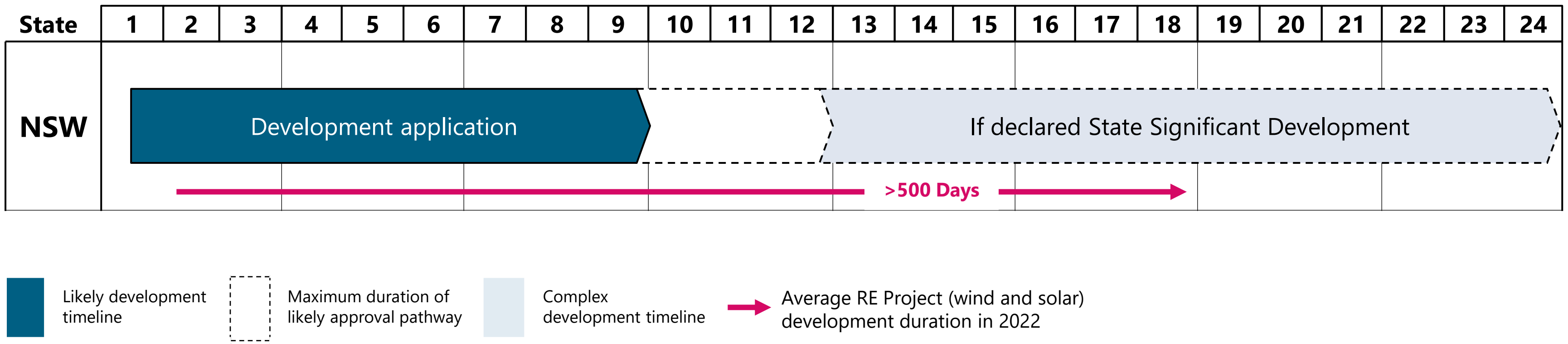
Approvals development timelines

Approval timelines vary by planning pathway, legislative requirements and application complexity.



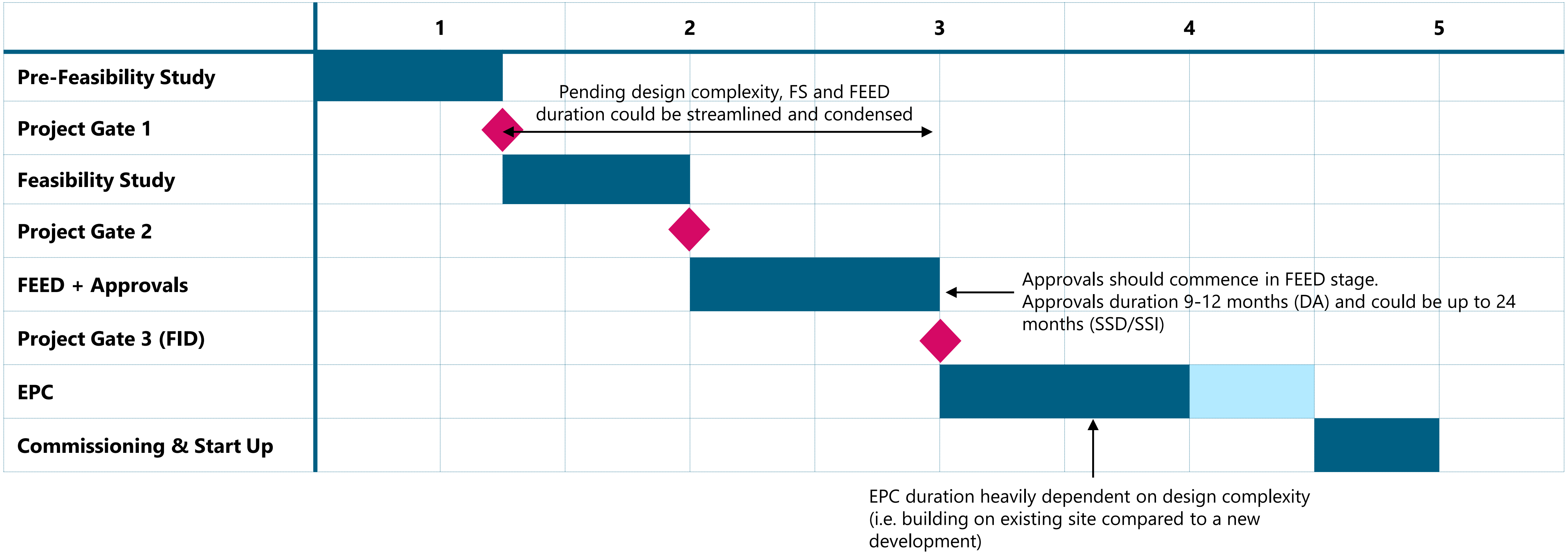
Typical Timeframe Details

- Local/Regionally Significant Development (DA) – 9 to 12 months.
- State Significant Development/Infrastructure (SSD/SSI) – 18 to 24 months
- Typical timeframe includes preparation of documentation, assessment and determination of application.
- Assumes project does not require approval under the EPBC Act.
- Specific site complexities and environmental issues may require greater levels of assessment for EIS and specialist studies.
- Number and complexity of submissions will determine timeframe to prepare Submissions Report for a SSDA.
- Timing for SSDA determination is variable depending on DPE assessment process and confirmation of consent authority which depends on number of objections (local Council and community).

Note: if land rezoning or other amendment is required to the LEP to permit the development (such as additional permitted uses on the land under Schedule 1), this planning proposal process can occur concurrently with a DA/SSDA. Otherwise, NSW DPE indicate that a standard (site-specific) planning proposal can take up to 320 days to be completed end-to-end from pre-lodgement to finalisation.

Typical Project Schedule

Durations of FS, FEED and EPC are dependent on design complexity. Overall duration is dependent on Approvals pathway and Proponent's project approval process and execution strategy



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ESG – Localised Considerations

The development of HRS will require consideration of potential adverse impacts on the environment and local communities.

Environmental Management

- Potential impacts to waterways, groundwater and soils
- Greenhouse gas (GHG) emissions profile, in particular if the hydrogen is produced using GHG intensive methods, such as steam methane reforming
- Air quality and noise
- Fire risk
- Cumulative impacts particularly if co-located in an existing industrial hub

Conservation and Biodiversity

- Extent of impacts to native vegetation and biodiversity.
- Potential for impacts to conservation significant species and communities

Community Impacts

- Potential impacts to community infrastructure and amenity both short and long term.
- Community concerns regarding safety of hydrogen refuelling stations, which could generate community resistance to the project. Early and timely engagement and communications will be required.

ESG – Risk and Mitigation Overview

A detailed ESG risk and mitigation plan will be required with some key risks and mitigations highlighted below.

Risk	Responsible	Description	Mitigation
Strain on water supply due to local Hydrogen production	Hay Shire Council	• Hay Shire Council operates a town water scheme for residents in designated areas. • Drought conditions put pressures on communities. • In times of extreme drought communities will look at pressures on water supply and council's involvement with and support for demanders.	Provide a detailed and public water management plan that has a clear action plan for demanders in times of drought.
Community resistance	Hay Shire Council and HRS Proponent	• Hydrogen as a feedstock is known amongst industrial stakeholders, however, as a fuel it is emerging as a potential fuel. Hydrogen is more flammable than petrol or natural gas[1] and therefore carries different risks to traditional logistics fuels. • Communities may be resistant to these risks and may be more acute depending where the assets are located. It may produce delays, increase costs or even halt a HRS project.	Pre-approval and construction engagement and communications need to be developed to educate community stakeholders on safe Hydrogen handling and the safety measures of any technology being applied.
Local business protestation regarding incentivisation of Proponent.	Hay Shire Council	• Local businesses, which are impacted from high interest rates and a sluggish economy, become disenfranchised with incentivisation of a 'future' fuel which does not currently benefit their business or sector. • This is exacerbated depending upon the type and size of incentives given to the Proponent. • The local business resistance could come in the form of protest and disruption of the development.	Providing key communications regarding council's intention to potentially incentivise a HRS Proponent and encourage feedback from local business stakeholders and actively seek to address concerns early.
Unmet expectation of employment and supply opportunities.	Hay Shire Council	• A considerable proportion (approx. 25-30%) of the Hay workforce are working as labourers, machine operators, technicians and trade workers, as a result there could be expectations of employment with the project. • Due to the complex nature of the engineering and construction profile of a HRS, local suppliers, labourers and tradespeople do not benefit financially from the development. • Stakeholder resistance could come in the form of lack of project acceptance and disruption of the development.	Council should consider placing performance caveats on any Proponent on local supply and employment opportunities and promote these to the community early. This could include 'ring fencing' certain scopes for local suppliers.
Permissibility of the development	Hay Shire Council and Proponent	• The final design does not meet localised planning regime and therefore the zoning does not permit the desired development. The project is halted with a financial impact for both council and the Proponent.	Careful consideration of candidate Proponent's designs and an early understanding that council may need to rezone or amend the LEP.

[1] Safe use of Hydrogen, Department of Energy, Office of Energy Efficiently and Renewable Energy, United States Government, https://www.energy.gov/eere/fuelcells/safe-use-hydrogen#:~:text=Specifically%2C%20hydrogen%20has%20a%20wide,design%20of%20safe%20hydrogen%20systems.

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Approvals regulatory overview

There are three main elements to the environmental legislative framework which regulates planning and development in NSW and the Hay Shire.

Legislation / Policy	Auth./Reg	Description and requirements	Recommended action
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999	DCCEEW	• Need to determine whether an action is likely to have a significant impact on the environment. This depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.	Undertake a site-specific assessment to determine any potential impacts on matters of national environmental significance.
State / Local			
Environmental Planning and Assessment Act 1979 (EP&A Act)	NSW Department of Planning and Environment (DPE)	• The primary land use planning statute in NSW. It governs matters such as planning administration, planning instruments and development assessments. • The objects of the Act are principles to guide planning authorities in making decisions. • Supported by the Environmental Planning and Assessment Regulation 2021.	Based on concept selection, determine appropriate development approval pathway and requirements.
State Environmental Planning Policies (SEPPs)	NSW DPE	• Outline when development consent is required, and which often nominate the consent authority for specific types of development. • There are 9 core SEPPs guiding separate planning principles from resilience and hazards, biodiversity and conservation to industry and employment. • Activation Precincts are created under the provisions of SEPP (Precincts—Regional) 2021, see further details on next page.	Dependent on site selection, undertake a site planning analysis that would identify project planning requirements/ permit triggers. Includes assessments of land use zones, site mapping, development standards and other related State and local provisions.
Hay Local Environmental Plan 2011 (LEP)	Hay Shire Council (Council)	• The LEP divides the Local Government Area into land use zones (e.g. RU1 Primary Production) and outlines development standards and local provisions.	
Protection of the Environment Operations Act 1997, etc.	Various	• Other licences, permits and approvals may be required pending the nature of the development and planning pathway.	Review and comply with other issued licences, permits and approvals.

Special Activation Precincts

The precincts are intended to create jobs and fuel economic development across regional NSW and build on the competitive and industrial strengths of each region.

A town may qualify for a special activation precinct (also known as Activation Precincts) if either:

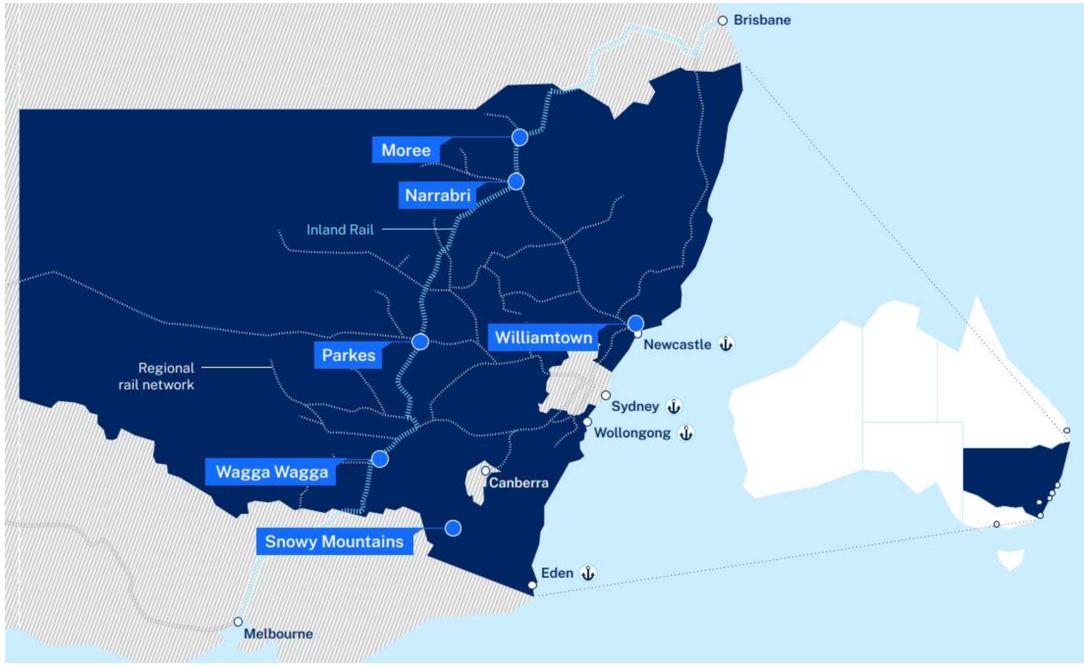
- the area aligns with the NSW Government's 20-year economic vision for regional NSW
- there are growth opportunities for new and existing industries
- population and jobs growth are expected to increase
- infrastructure projects are underway or expected, such as the inland rail.

NSW DPE are responsible for preparing the planning framework for each Activation precinct. This process can take on average 2-3 years to complete. This involves upfront strategic environmental impact assessment to identify the opportunities and limitations of each precinct and likely impacts of certain land uses. The SEPP (Precincts—Regional) 2021 also requires a master plan and delivery plan to be finalised before development starts.

When preparing an application for development, the applicant must complete a strategic merit assessment step to get an Activation Precinct Certificate from Regional Growth NSW Development Corporation. The requirements will ensure future development is consistent with the vision for the precincts, and in line with planning controls.

The LEP and Chapter 2 of SEPP (Planning Systems) 2021 does not apply to land within an Activation Precinct.

Precincts are currently established at Moree, Narrabri, Parkes, Wagga Wagga, Snowy Mountains and Williamtown.



Source: Regional Growth NSW Development Corporation

Project classification

A variety of planning pathways exist under the NSW planning system depending on factors such as the type and scale of development, the proponent and capital investment value.

Project type	Description	Trigger or threshold	Applicable Approval / planning requirements
Local Development	A local development is the most common type of development in NSW. The Council determines DAs for local development.	• If permissible with consent in the land use zone and none of the below	• A DA is required including: 1) a description of the development 2) The estimated cost 3) development plans and 4) environmental assessment, i.e. Statement of Environment Effects or Environmental Impact Statement (EIS) (for designated development) pending on potential impacts.
Regionally Significant Development	A regionally significant development is larger in investment value, scale and/or complexity. The Western Regional Planning Panel is made up of independent experts decide whether to approve this development.	• More than $5M capital investment value (CIV) for Council related development, or • More than $30M CIV for general development	• As above. • The panel will make its determination by considering the application and advice from the Council. • Applicants can present their case to the panel. • The process takes up to 250 days, although this may be extended for very complex case
State Significant Development (SSD)	Projects that are of strategic importance of the development to NSW. All SSD projects require development consent from either an Independent Planning Commission (IPC) or the Minister before they may proceed.	• More than $30M CIV in gas or chemical storage • More than 50 tonnes hydrogen present	• Likely to meet trigger for SSD based on CIV estimate. • All SSD applications are to be accompanied by an EIS that addresses Planning Secretary's Environmental Assessment Requirements (SEARs). • Prior to determination, SSD applications are subject to comprehensive assessment with extensive community participation.
State Significant Infrastructure (SSI)	State significant infrastructure includes transport and services developments with effects beyond local areas. All SSI projects require approval from the Minister before they may proceed.	• If the activity is, or is on land, declared state significant infrastructure under SEPP (Planning Systems) 2021	• Highly unlikely given the nature of the proposed development unless impacting major infrastructure or declared SSI.

Planning pathways

An established process for assessment and approval of local, regionally significant and state significant development under the NSW planning system.

Local/Regionally Significant DA Process

In the case where future development is classified as local development or regionally significant development, the typical DA approvals process is:

- Applicant checks the permissibility and planning pathway of the development under the relevant environmental planning instruments, e.g. SEPPs and the LEP and other relevant environmental legislation.
- Applicant arranges for and attends a Pre-DA meeting with the Council, if required.
- Applicant prepares the documentation required for the DA – primarily the SEE, supporting plans, specialist reports, and other supporting information required by the Council to address identified planning and environmental issues.
- Applicant lodges the DA via the NSW Planning Portal. Once accepted, a payment advice with relevant fees is uploaded by the Council to the NSW Planning Portal for the Applicant to then make payment.
- Within 7 days of receiving a DA for regionally significant development, the Council registers the DA with the Secretariat.
- Generally within 28 days of the lodgement of a DA, the Secretariat will arrange a Kick-off briefing between the Panel, relevant Council staff and the Applicant.
- The DA is referred by the Council to their internal departments and other external agencies for review, where required.
- DA public exhibition period (minimum 14 days) arranged and managed by the Council.
- Council's DA assessment officer reviews the submitted DA and requests any additional information including response to submissions, if required, from the Applicant.
- For contentious matters, where the DA has attracted 10 or more unique submissions by way of objection, the Western Region Planning Panel will generally hold a public determination meeting to consider the DA.
- Council (or Western Region Planning Panel in certain cases) determines the DA and issue conditions of consent for an approved DA. For integrated developments, the external agencies issue general terms of approval for inclusion with the development consent.
- Post-approval activities include the Applicant obtaining any Construction and Occupation Certificates and any other approvals, permits and licences under other legislation.

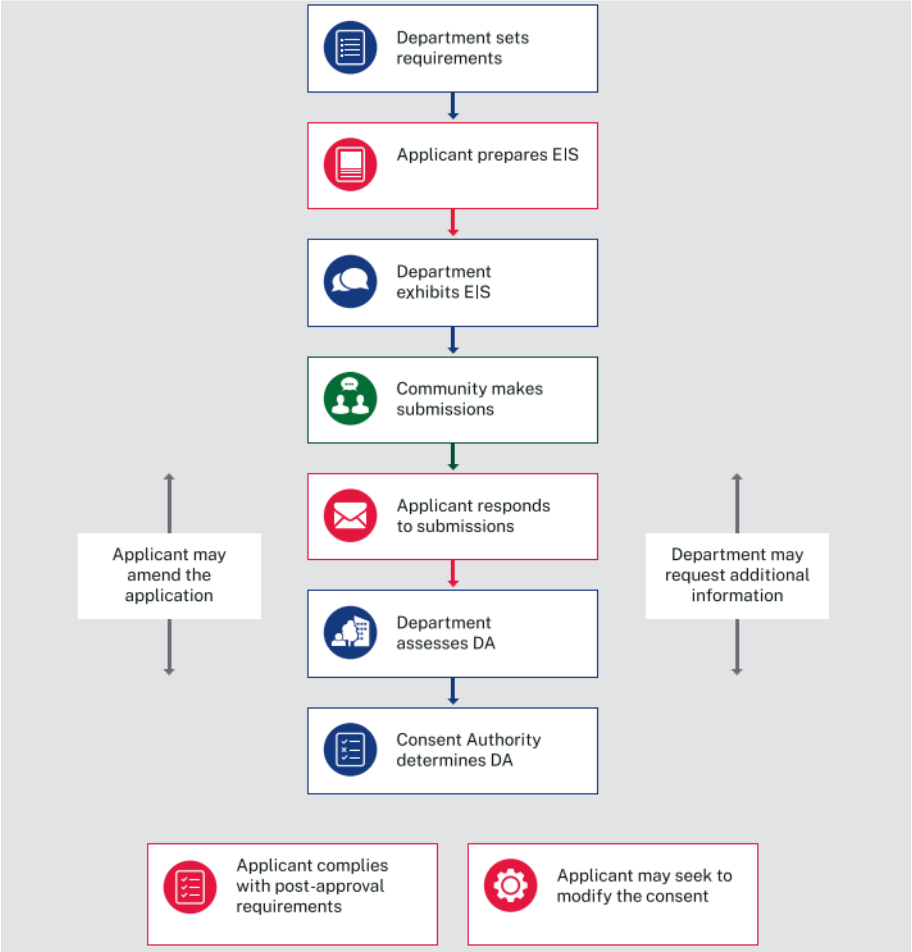
Planning pathways

An established process for assessment and approval of local, regionally significant and state significant development under the NSW planning system.

SSD Application Process

For development that is declared SSD, the typical approvals process is:

- Applicant checks the permissibility and planning pathway of the development and other relevant environmental legislation.
- Applicant arranges for and attends a pre-lodgement meeting with NSW DPE, if required.
- Applicant prepares and lodges a Scoping Report with NSW DPE via NSW Planning Portal. NSW DPE and key agencies review and SEARs are issued (where are project-specific).
- During the preparation of the EIS consultation is undertaken with government authorities, infrastructure and service providers, community groups and affected landowners. Consultation process, issues raised, and any design changes documented in the EIS.
- Applicant prepares EIS and specialist studies in accordance with the issued SEARs and lodges documentation to NSW DPE via NSW Planning Portal. The EIS must be reviewed and certified by a Registered Environmental Assessment Practitioner (REAP) under the NSW Government's REAP scheme.
- DPE arrange public exhibition of the SSDA (for at least 28 days) and provide all submissions to Applicant for review with a request to prepare a Submissions Report and provide response to any other items requiring further information/clarification.
- DPE completes its assessment of the SSDA and provides Applicant with copy of draft conditions of consent for review and comment. Determination of the SSDA by either the Minister for Planning and Public Spaces (or delegate) or the IPC. The IPC may hold public meetings if they are the designated consent authority.
- Preparation of other licence, permit and approval applications will depend upon the specific site (noting some other approvals not required for an approved SSD application) and any conditions of consent.



Source: NSW DPE

Advisian

Worley Group

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Kick-off and Framing Workshop

We understand your intent to explore the viability of producing green hydrogen for Heavy Transportation

Background

The intent of this study is to ***develop a business case for the development of Green Hydrogen Production for Heavy Transport in Hay NSW.***

Hay is strategically located on the major transport corridor between Sydney and Perth. It has a supply of waste-water (identified by NSW Govt) and is in the heart of the NSW South West Renewable Energy Zone.

Hay Shire Council wishes to ensure the Sturt Highway is developed to provide further certainty to hydrogen fleet operators, now and into the future.

Objectives

The intent of this initial business case is to investigate the viability of:

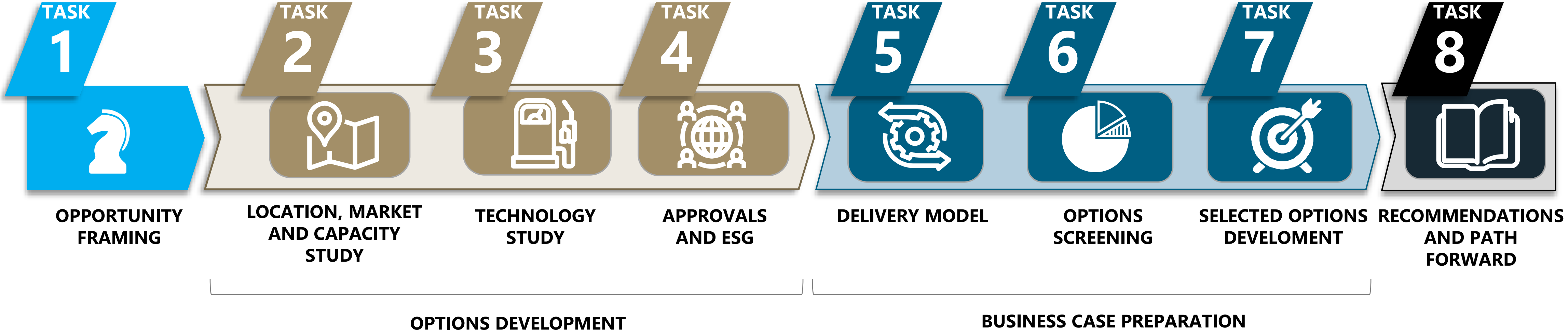
- A new industry that uses available natural capital to derive wealth, economic activity, and jobs.
- A regionally located industry that will help the region and State to decarbonise the economy.
- An industry that will provide critical infrastructure to secure the transport corridor for the region as the Transport industry moves towards Hydrogen Fuel.

Outcomes

The desired outcome is a completed ***Regional NSW Infrastructure Business Case Template*** that clearly and concisely defines:

- ✓ the case for change,
- ✓ analysis of business options and their associated costs and benefits, and
- ✓ the implementation pathway.

Our approach to achieving the assignment deliverables



Framing objectives

Framing your hydrogen vision is the critical first step to realizing the objectives of the study.

A

VISION: What are the strategic drivers and targets underpinning Hay Shire's hydrogen vision?

B

PLAY: What are the priority applications, services and assets Hay Shire intends to target?

C

MARKET FIT: competitive advantage, capability gaps and appetite for partnerships.

D

SUCCESS: What is an attractive hydrogen opportunity for Hay Shire? Define the key commercial and risk boundaries.

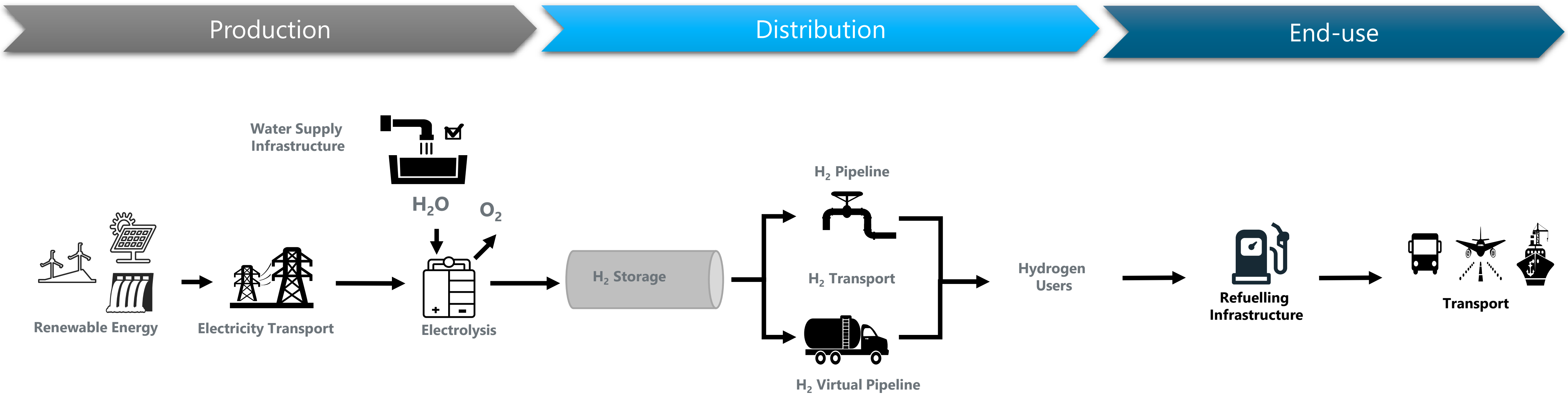
We are starting to develop an appreciation of your hydrogen vision

Initial insights to be expanded upon through framing discussion

Why hydrogen	Targets	Competitive advantage	Capabilities and partnership logic	Commercial and risk boundaries	Opportunity vision
Hydrogen is a powerful decarbonization lever	Target end-use sector is heavy vehicle line haul	Strategic location on the Sydney-Perth Highway	NSW South West Renewable Energy Zone	Prepared to take on development risk to provide certainty to H2 fleet operators	First mover to anchor hydrogen production and derive economic prosperity for Hay Shire
Transport industry is moving towards Hydrogen Fuel	Sturt Highway South-west NSW	Access to natural capital in the form of a waste-water source	Partnership may be required to gain Hydrogen market knowledge and end-use commercial capabilities	State and Federal financing limitations and project dependencies	Establish critical hydrogen infrastructure to secure the Sturt Highway transport corridor for the region

Hydrogen value chain

Consideration of the Hydrogen value chain will help to frame where and in what role Hay Shire wants to engage in



Summary and discussion points (1/3)

Key topics	Discussion questions	Implications for study / HSC response
Why Hydrogen?	1. Why have you decided to focus on hydrogen? 2. Are you involved in any other hydrogen projects or initiatives? Why have you selected those projects? 3. Do you have corporate targets associated with hydrogen? If so, why have you established them?	1. Decarbonisation of local economy is critical, heavy reliance on agriculture in the region. Hydrogen fits in with the communities' interests and focus on decarbonisation of economies. Bringing together regions capabilities, agriculture focus, interests and future industries that will leverage the existing strengths of agriculture and location within major transport corridor (Sydney-Perth). The NSW SW Regional Energy Zone allows for hydrogen implementation to be most achievable as water and renewables are being developed, especially when hydrogen is linked with heavy vehicle transport. 2. No other projects, taken on this one to understand a business case for hydrogen applicability in the region and demonstrate Hay Shire's commitment to decarbonize to the community. 3. Currently limited skills and knowledge in the local government on renewables. Completing work in coming months to develop ESG and corporate targets. Requirements to support local industry, understanding how they incorporate renewable options into their community. Renewable energy implementation by 2027, date is dependent on supply chain and private companies.
Targets	1. Where along the renewable hydrogen value chain do you want to focus? In any particular role? i). Variable renewable energy production? ii). Hydrogen production? iii). Energy storage and transmission? iv). Refuelling stations? 2. Have you already identified any locations in Hay for relevant components of the value chain? 3. Who is your end customer or customers? What are the reasons for targeting them?	1. HSC sees itself as a proponent facilitator role. They can provide land use and water access. i). Renewable energy coming to the region, access scheme is controlled by Energy Co. They have set out what is required of energy generators, planning agreement/community benefits scheme to possibly include into hydrogen production for heavy vehicles. ii). No interest in hydrogen production. iii). Energy storage and transmission developed externally. iv). Ideal need for Hydrogen Refueling Stations ("HRS"), operated by private sector though. 2. Yes, 3 locations along Sturt Highway SW NSW. *i). Council owned;* Area of land is zoned industrial, owned by government slightly off Sturt highway. *ii).. Macquarie;* Area directly alongside Sturt highway, slipway access off the highway. *iii). Rice Growers Australia;* Area alongside Sturt highway, slipway access off the highway. Additional locations will be assessed to ensure completeness and reduce land conflict tradeoff between agriculture use and renewable energy supply. Identification of potential synergies with other industries would be good to consider as part of developing the business case. Hay to provide exact locations already considered, as well as information on location and availability of water resources (Availability, volumes, licenses, sources – Murrumbidgee/Irrigated/Filtered excess etc.). 3. Heavy vehicles in NSW regional corridor is primary customer. Extend this to wider community depending on supporting industries being developed.

Summary and discussion points (2/3)

Key topics	Discussion questions	Implications for study / HSC response
Capabilities and partnership roles	1. What are your current hydrogen or renewable energy related capabilities? 2. Do you have capability gaps and if so, are you planning to develop these? 3. Are you considering outsourcing specific parts of project development? 4. Do you think you will need to establish partnerships along the value chain? For which parts? 5. What role would you like to take in a partnership? 6. Do you have any existing relevant strategic partners?	1. Opportunities for energy generators coming into the region with hydrogen corporate goals already (ENGIE) 2. Lots of gaps, knowledge, human capital. Looking to build partnerships to develop the region. 3. Yes, primary role is expected to be a proponent facilitator. Rest will be partnerships outsourced. 4. Yes, most aspects of the value chain. E.g. Logistics, can include TOLL, Linfox etc. Existing opportunity for them to setup infrastructure along HSC corridor. 5. Proponent facilitator role, allowing for social license for these projects to happen. Facilitating relationships between state/federal/private capital. Council recognises limitations, currently don't have the capacity or knowledge to implement the project without strategic partners. 6. Primary strategic partnerships are associated with NSW Gov and the NSW SW regional energy zone.
Commercial and risk boundaries	1. How do you plan to finance your hydrogen vision? Do you have any financing constraints? 2. Do you have a particular delivery model in mind (i.e.. project funding or development contract?) 3. Do you have any hurdle rates or project return requirements in the short, medium and long term? 4. What level of risk are you willing to take and what is your willingness to adapt your risk profile?	1. Hay Shire does not intend to take a project development role in the production of green hydrogen. Instead, the intention is to demonstrate a business case that helps to attract government funding and private sector investment, with Hay Shire acting as a proponent to support project funding and planning submissions. The council can support with the contribution of land and water for projects and there is a community benefits scheme under the management of Energy Co that could potentially contribute/support project funding. 2. Diversification of the economy, job creation and follow-on economic impact of these jobs. 3. Nothing set, capitalizing on related projects opportunities and infrastructure, state and federal opportunities available. 4. Comfortable taking on risk to draw in investment from private sector. Financial risk is zero although.

Summary and discussion points (3/3)

Key topics	Discussion questions	Implications for study / HSC response
Competitive advantage	1. What competitive advantages do you have for the development of your hydrogen vision? 2. What does the competitive landscape look like for your project, i.e.. alternative transport modalities, regions, highways? 3. What are the main barriers to entry?	1. Location of HSC at a junction of 3 highways – Sturt, Cobb and Midwestern. Ideally situated with access to water and renewable energy (from NSW SW Energy Zone). Also situated in the centre of massive cropping area, can do ammonia production given lots of fertilizer used in the area. Advisian can incorporate analysis for synergies with this. Lots of alternative transport (tractors, agriculture equipment etc.). 2. Hume Highway drawing state funding away from Sturt highway. NSW government focusing on areas with skilled labour and established infrastructure. Aim of this business case is to identify and justify the opportunities in HSC, aiming to reduce the perception of risk in this region. Want to keep corridor open, decarbonize transport, ensuring Sturt Highway route stays relevant. Dubbo, Albury Parks, (other regional NSW) have Special Activation Precincts with 30-day project approval process instead of the standard 18-month turnaround that the HSC has. 3. Approvals, access to land, environmental planning (land claims, capital, physical location is ADV and DISADV as infrastructure development is difficult because of relative isolation). Other possible barriers include refueling limitations, location in relation to other planned or established HRS' for long haul routes. Need to assess synergies in the bigger picture; assessing SA and WA opportunities and how they relate to HRS' along this highway.
Opportunity vision	1. What is Hay Council's overarching hydrogen vision? 2. How will you rank opportunity attractiveness within this overarching vision? 3. How will you leverage project outcomes to further your vision?	1. Establish critical hydrogen infrastructure to secure Sturt Highway transport corridor for the region. Draw economic prosperity to HSC by leveraging situational factors such as NSW SW Energy Zone. There are resources available, need to future proof the economic prosperity of the region. 2. MCA to be established, HSC council favouring economic activity and stability of the region. Given who business case is aimed at, big focus on decarbonizing the economy, attracting investment to the region to stimulate jobs, social impact, environmental impact, advancing technology and new industry of hydrogen production. HRS establishment is a major aim of the business case – this alone would be an attractive outcome. Integration of HRS and production together is best case for both. 3. Lobby to state government, discussion/attraction tool for investors along the value chain.

FCEV Truck Technical Specifications

Heavy Rigid Vehicles – Hyzon HYHD8-110

Hyzon is an established FCEV supplier in Australia.

Vehicle details

Class	Heavy vehicle
Name	HYHD8-110
Primary company	Hyzon
Supporting OEM's	-
Status	Operating
Operating year	2021
Established markets	North America, Australia

Impact to Hydrogen mobility solutions

Strengths	• Company has a global presence and is established in Australia	**Weaknesses**	• Very small uptake in non-variable conditions (cities). Impact for freight services over long distances is unclear.
Opportunities	• Currently completing extensive trials throughout North America to support uptake in all conditions. Pivotal time to implement in Australia	**Threats**	• BEV heavy rigid market is developing faster than FCEV heavy rigid market

Key takeaway

Hyzon has a wider range of FC heavy rigid vehicles than other OEM suppliers and is established in Australia

Vehicle Specifications	
Pressure class (bar)	350
Range (km)	560
H2 Capacity (kg)	50
H2 Fuel cell size (kW)	110
Refuelling time (min)	15
Max speed (km/h)	106
Fuel economy (km/kg)	11.2
Chassis length (mm)	8,028
Chassis height (mm)	3,454
Chassis width (mm)	2,460
GCM (t)	24
Seating capacity	2

Heavy Rigid Vehicles – Hyzon HYMAX 450 6x4

Hyundai is an established FCEV supplier in Australia with multiple FCET models available.

Vehicle details	
Class	Heavy vehicle
Name	HYMAX 450 6x4
Primary company	Hyzon
Supporting OEM's	-
Status	Operating
Operating year	2021
Established markets	Europe, Australia, Asia

Vehicle Specifications	
Pressure class (bar)	350
Range (km)	400
H2 Capacity (kg)	30
H2 Fuel cell size (kW)	80
Refuelling time (min)	15
Max speed (km/h)	106
Fuel economy (km/kg)	13.3
Chassis length (mm)	11,280
Chassis height (mm)	2,880
Chassis width (mm)	2,470
GCM (t)	24
Seating capacity	2

Impact to Hydrogen mobility solutions			
Strengths	• Company has a global presence and is established in Australia • 2 x vehicles being utilised for Port Kembla HRS trial in Wollongong	**Weaknesses**	• Very small uptake in non-variable conditions (cities). Impact for freight services over long distances is unclear.
Opportunities	• Currently completing extensive trials throughout North America to support uptake in all conditions. Pivotal time to implement in Australia	**Threats**	• BEV heavy rigid market is developing faster than FCEV heavy rigid market

Key takeaway

Hyzon has a wider range of FC heavy rigid vehicles than other OEM suppliers and is established in Australia

Heavy Rigid Vehicles – Hyundai Xcient FC 6x2

Hyundai is an established supplier in Australia, but is limited by FCEVs maximum speed.

Vehicle details	
Class	Heavy vehicle
Name	Xcient FC 6x2
Primary company	Hyundai
Supporting OEM's	H2 Energy
Status	Operating
Operating year	2020
Established markets	South Korea, Europe, USA

Vehicle Specifications	
Pressure class (bar)	350
Range (km)	400
H2 Capacity (kg)	31
H2 Fuel cell size (kW)	180
Refuelling time (min)	8-20
Max speed (km/h)	85
Fuel economy (km/kg)	12.9
Chassis length (mm)	9,745
Chassis height (mm)	3,730
Chassis width (mm)	2,600
GCM (t)	42
Seating capacity	3

Impact to Hydrogen mobility solutions

Strengths	• Company has a global presence and is established in Australia • Large cargo pull load	**Weaknesses**	• Maximum speed of 85 km/h not suitable for Australian roads • Limited plans for Xcient in Australia
Opportunities	• Proven technology in SK/Europe/North America, Hyundai trialling FC passenger vehicles (Hyundai Nexo) in Canberra; opportunity to expand into FCETs.	**Threats**	• BEV heavy rigid market is developing faster than FCEV heavy rigid market

Key takeaway

Maximum speed of 85 km/h not suitable for Australian roads.

Heavy Rigid Vehicles – HDrive T23-H220

HDrive is an established supplier in Australia with a MoU to supply Australia with 12,000 FCET's by 2028.

Vehicle details	
Class	Heavy vehicle
Name	T23-H220
Primary company	HDrive
Supporting OEM's	Pure Hydrogen
Status	Operating
Operating year	2023
Established markets	Australia, China

Vehicle Specifications	
Pressure class (bar)	700
Range (km)	450-850
H2 Capacity (kg)	70
H2 Fuel cell size (kW)	220
Refuelling time (min)	15-20
Max speed (km/h)	100
Fuel economy (km/kg)	6.4-12.1
Chassis length (mm)	9,020
Chassis height (mm)	4,000
Chassis width (mm)	2,500
GCM (t)	23
Seating capacity	2

Impact to Hydrogen mobility solutions

Strengths	• Company has a global presence and is established in Australia	**Weaknesses**	• Not a widely implemented and scaled vehicle internationally; conflicting reports on vehicle specifications
Opportunities	• MoU has been developed with HDrive and New Wisdom Motors to supply 12,000 FCET to Australia by 2028, but haven't allocated all vehicles to customers yet.	**Threats**	• BEV heavy rigid market is developing faster than FCEV heavy rigid market

Key takeaway

HDrive's MoU to supply Australia with 12,000 FCET by 2028 provides an opportunity for HSC to readily direct vehicle supply.

Articulated Trucks – Hyzon HYMAX 450 6x4

Hyundai is an established FCEV supplier in Australia with multiple FCET models available.

Vehicle details	
Class	Heavy vehicle
Name	HYMAX 450 6x4
Primary company	Hyzon
Supporting OEM's	-
Status	Operating
Operating year	2021
Established markets	Europe, Australia, Asia

Vehicle Specifications		
Model variation	*46t model*	*70t model*
Pressure class (bar)	350	350
Range (km)	680	600
H2 Capacity (kg)	50-60	50-60
H2 Fuel cell size (kW)	200	295
Refuelling time (min)	15	15
Max speed (km/h)	106	106
Fuel economy (km/kg)	9.7	6.5
Chassis length (mm)	6,820	7,330
Chassis height (mm)	2,990	2,970
Chassis width (mm)	2,460	2,450
GCM (t)	**46**	**70**
Seating capacity	2	2

Impact to Hydrogen mobility solutions

Strengths	• Company has a global presence and is established in Australia • 2 x vehicles being utilised for Port Kembla HRS trial in Wollongong	**Weaknesses**	• Very small uptake in non-variable conditions (cities). Impact for freight services over long distances is unclear.
Opportunities	• Currently completing extensive trials throughout North America to support uptake in all conditions. Pivotal time to implement in Australia	**Threats**	• BET market is developing faster than FCET market

Key takeaway

Hyzon has a wider range of FC heavy rigid vehicles than other OEM suppliers and is established in Australia

Articulated Trucks – Nikola TRE FCEV

Nikola is an established FCET OEM in North America, but have no plans to expand this market to Australia

Vehicle details	
Class	Heavy vehicle
Name	TRE FCEV
Primary company	Nikola Motors
Supporting OEM's	-
Status	Operating
Operating year	2023
Established markets	North America, Europe

Impact to Hydrogen mobility solutions			
Strengths	• Cheaper FCET than competitors	**Weaknesses**	• No plans to integrate FCETs into the Australian market
Opportunities	• If government support increases in Australia, opportunity to locally supply FCETs that have already been established in North America and Europe.	**Threats**	• BET market is developing faster than FCET market

Key takeaway
Despite Nikola Motors having offices established in Australia, they have no plans to expand FCETs into the Australian market.

Vehicle Specifications	
Pressure class (bar)	700
Range (km)	800
H2 Capacity (kg)	70
H2 Fuel cell size (kW)	200
Refuelling time (min)	< 20
Max speed (km/h)	112
Fuel economy (km/kg)	11.4
Chassis length (mm)	2,577
Chassis height (mm)	3,721
Chassis width (mm)	2,631
GCM (t)	37.2
Seating capacity	2

Articulated Trucks – Hyundai Xcient Tractor 6x4

Hyundai is an established supplier in Australia, but is limited by FCEVs maximum speed.

Vehicle details	
Class	Heavy vehicle
Name	Xcient Tractor FC 6x2
Primary company	Hyundai
Supporting OEM's	H2 Energy
Status	Operating
Operating year	2023
Established markets	North America

Impact to Hydrogen mobility solutions			
Strengths	• Company has a global presence and is established in Australia	**Weaknesses**	• Maximum speed of 85 km/h not suitable for Australian roads • Limited plans for Xcient in Australia
Opportunities	• Proven technology in North America, Hyundai trialling FC passenger vehicles (Hyundai Nexo) in Canberra; opportunity to expand into FCETs.	**Threats**	• BET market is developing faster than FCET market

Key takeaway
Maximum speed of 85 km/h not suitable for Australian roads.

Vehicle Specifications	
Pressure class (bar)	700
Range (km)	725
H2 Capacity (kg)	68.5
H2 Fuel cell size (kW)	180
Refuelling time (min)	8-20
Max speed (km/h)	85
Fuel economy (km/kg)	10.6
Chassis length (mm)	8,788
Chassis height (mm)	4,089
Chassis width (mm)	2,590
GCM (t)	37.2
Seating capacity	2

Articulated Trucks – HDrive HP70-440

HDrive is an established supplier in Australia with a MoU to supply Australia with 12,000 FCET's by 2028.

Vehicle details	
Class	Heavy vehicle
Name	HP70-440
Primary company	HDrive
Supporting OEM's	Pure Hydrogen
Status	Operating
Operating year	2023
Established markets	China, Australia

Impact to Hydrogen mobility solutions			
Strengths	• Company has a global presence and is established in Australia	**Weaknesses**	• Not widely implemented vehicle, range is a minimum and doesn't reflect full potential of the vehicle – difficult to model feasibility and compare against FCETs.
Opportunities	• Currently developing FCETs for NSW/VIC gov • MoU has been developed with HDrive and New Wisdom Motors to supply 12,000 FCET to Australia by 2028, but haven't allocated all vehicles to customers	**Threats**	• BET market is developing faster than FCET market

Key takeaway

HDrive's MoU to supply Australia with 12,000 FCET by 2028 provides an opportunity for HSC to readily direct vehicle supply.

Vehicle Specifications	
Pressure class (bar)	700
Range (km)	≥500
H2 Capacity (kg)	70
H2 Fuel cell size (kW)	440
Refuelling time (min)	15-20
Max speed (km/h)	100
Fuel economy (km/kg)	≥7.1
Chassis length (mm)	7,950
Chassis height (mm)	3,950
Chassis width (mm)	2,500
GCM (t)	68
Seating capacity	2