



**H2 FUTURE MOBILITY
DAY #5**

7 December 2023



www.portkembalahydrogenhub.com.au

H₂ PORT KEMBLA HYDROGEN HUB

Future Mobility Day #5
7 December 2023

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HOME · NEWS · ENERGY

Coregas launches Australia's first hydrogen refuelling station for heavy transport vehicles

JULY 25, 2023




H2 Future Mobility Day #5 Program

- BlueScope Visitor Centre
- 7 December 2023

12.00pm	Welcome - Creating local content	Nigel McKinnon Dept of Regional NSW
12.10pm	FCEV Technology - Deploying a hydrogen heavy vehicle into service	Chris Wade Remondis
12.30pm	H2ICE Technology - Commercialising UNSW Engine Lab research	Shawn Kook DeCarice
12.45pm	Lunch	
1.15pm	Coregas H2Station - Site Tour	Wodek Jakubik Coregas
2.30pm	Return to Visitor Centre	



The background of the slide is a vibrant Aboriginal-style artwork. It features a central light blue area containing text, surrounded by intricate patterns in orange, brown, and dark blue. The top left shows a night sky with stars and a crescent moon. The bottom left depicts a river with a fish. The bottom right shows a whale breaching the water. The entire design is framed by a decorative border with white dots and wavy lines.

The Department of Regional New South Wales acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work.

Coregas launches Australia's first hydrogen refuelling station for heavy transport vehicles



JULY 25, 2023



PRESS RELEASE

GE Technology to Power Australia's First Dual-Fuel Gas and Hydrogen Power Plant

June 16, 2021

Major Energy Projects

By the end of 2024, **\$700m+** of supportive **major energy projects** will transform the **Port Kembla Hydrogen Hub ecosystem**. These projects include:

- **Coregas - Hydrogen Refuelling Station** will enable Australia's first zero emissions **heavy vehicle trials**, including the **Remondis** hydrogen refuse truck
- **Squadron Energy - Port Kembla Energy Terminal** will deliver Australia's first **gas importation** facility
- **Jemena - Port Kembla Pipeline Duplication + upgrades to the Eastern Gas Pipeline** will deliver increased **gas network capacity**
- **EnergyAustralia** - construction of **Tallawarra B** and the **Tallawarra A upgrade** will deliver Australia's first **dual fuel capable power stations**.



COREGAS

h₂ station

Clean Mobility Revolution

OFFICIAL OPENING - 28 JULY 2023

WWW.COREGAS.COM.AU

A GREAT LEAP TOWARDS A **DECARBONIZED ENERGY FUTURE IN AUSTRALIA**

EnergyAustralia's Tallawarra B 316MW dual-fuel, gas and green Hydrogen power plant



1st natural gas + green Hydrogen dual-fuel peaker power plant in Australia



Utilizing GE's **decades of experience in burning Hydrogen** in gas turbines



Contributing to Australia's goals in delivering **up to 1GW dispatchable power** while ensuring transition to a lower carbon energy future



1st large scale heavy-duty gas turbine power project in Australia in 12 years



Supporting growth in **renewables** in the phase-out of coal-fired power generation



EnergyAustralia expects to contribute **AU\$300 million** to the economy and create **250 jobs** during the construction phase



1st GE 9F.05 gas turbine to generate reliable and affordable power in Australia



GE 9F Fleet ... **> 450 units** operating in 40 countries ... clocked over **24 million hours**



GE's F-class gas turbine portfolio is capable to burn H₂ from **5% to 100% by Vol levels**





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GE  91.17

PRESS RELEASE

EnergyAustralia Modernizes Tallawarra A Power Plant to Support Energy Transition in Australia

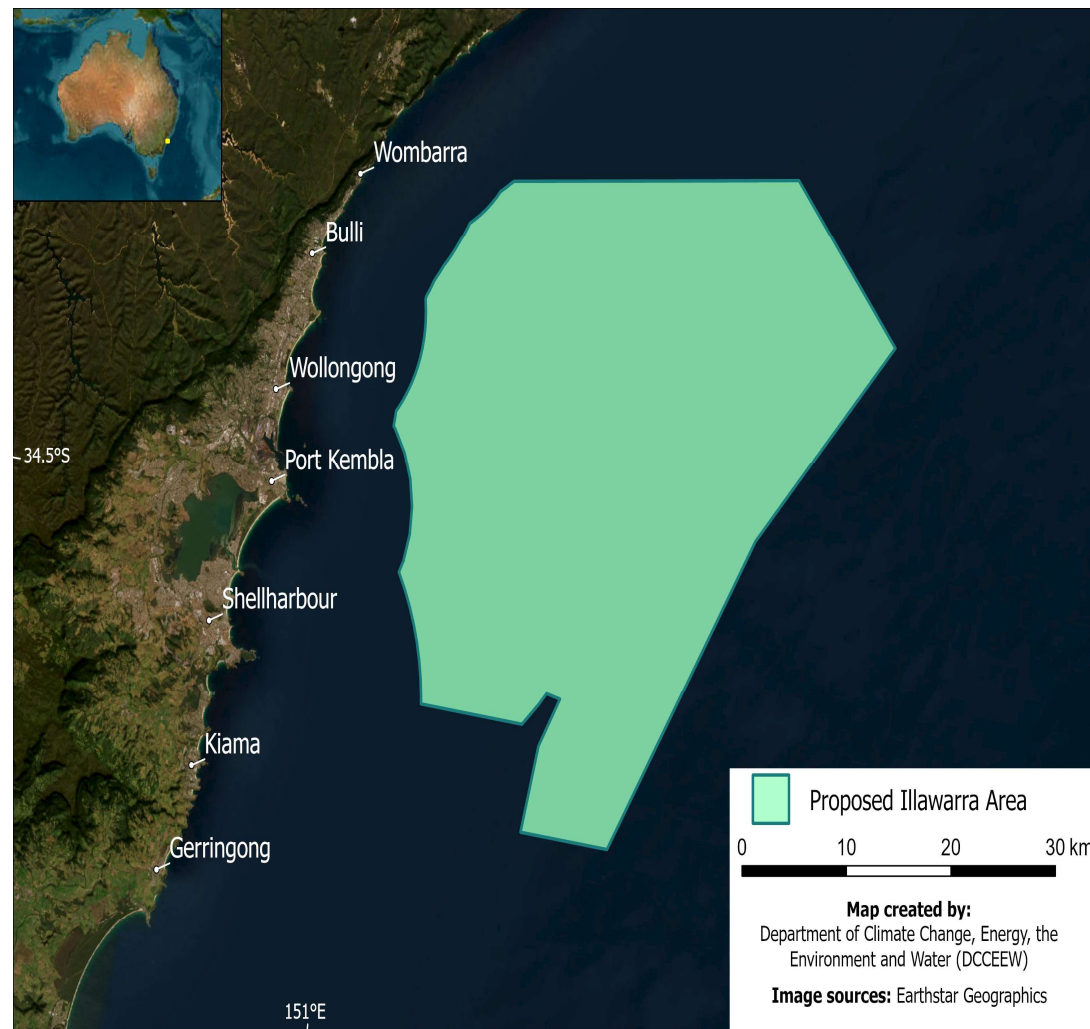
March 07, 2023

Renewable Energy and Offshore Wind Zones

The **NSW Government** has declared the Illawarra region a **Renewable Energy Zone (REZ)**. An **EOI process** in 2022 generated **44 projects** representing **\$43 billion** in potential investment. **Projects** included **green hydrogen** production and **renewable energy** from **offshore wind farms**.

In **August 2023**, the proposed **Illawarra Offshore Wind Zone** was announced by the Australian Government. Covering **1,461 square kilometres**, the Offshore Wind Zone has the potential to generate **4.2GW** in **renewable energy**.

NSW Ports have released **concept plans** for a dedicated **30 hectare precinct** to support the **offshore wind** industry's development at Port Kembla.



22 FEBRUARY 2023

Port Kembla lays foundation for offshore wind industry



Image: One of NSW Ports' concept plans for a port facility in Port Kembla to support the development of offshore wind development projects.

Electrolyser Manufacturing - Hysata

Port Kembla is home to the **Hysata** 8,000 square metre **global headquarters**. The company's **revolutionary electrolyser** design brings higher efficiency to **green hydrogen** production.

The **Hysata electrolyser** features the world's highest **system efficiency at 95 percent** compared to the **industry average of 75 percent**.

Featuring simplified **balance of plant** that reduces the need for **expensive cooling**, the Hysata electrolyser **modular design** is easier to **manufacture and scale**.

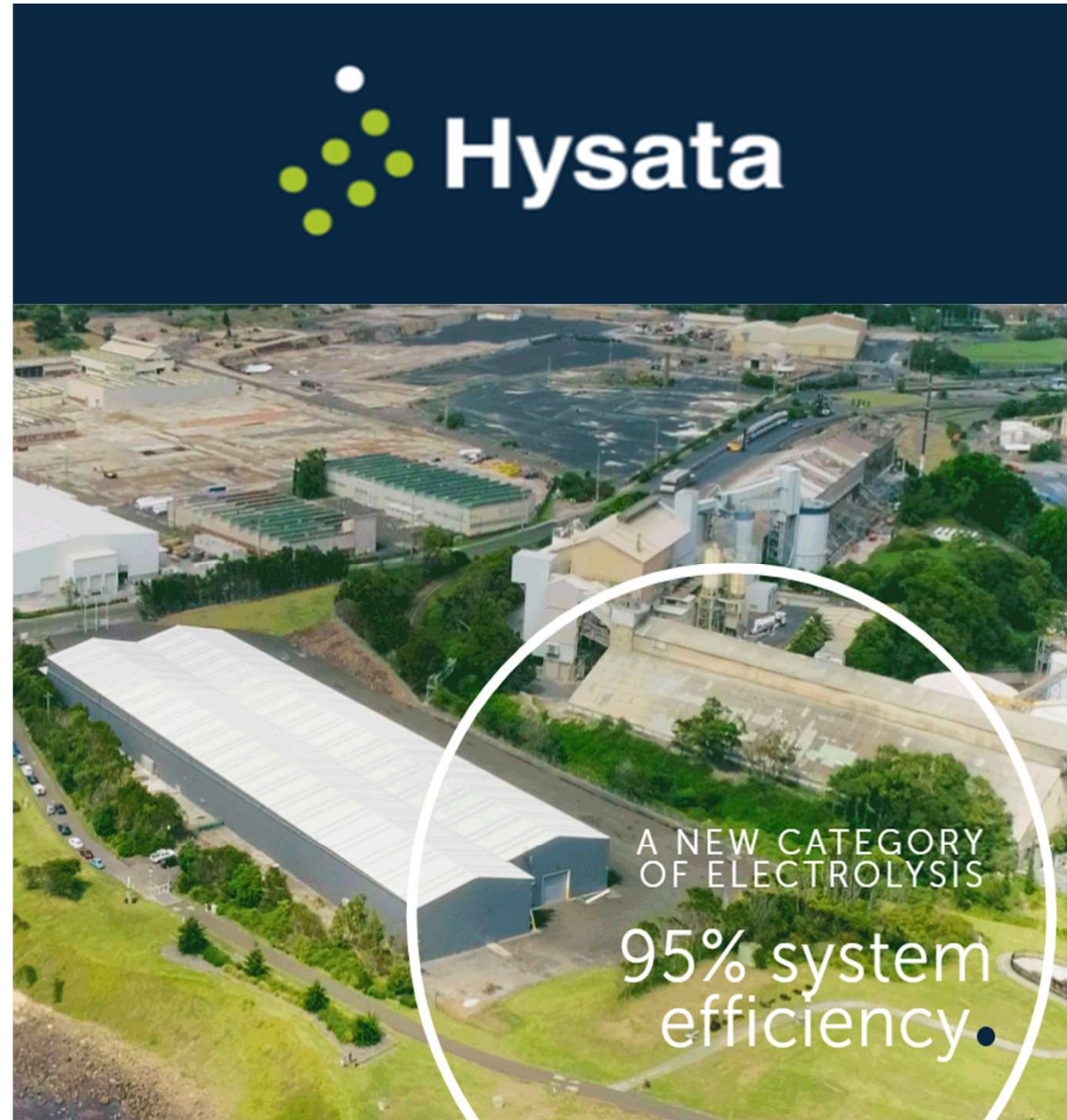
WE PROUDLY

Partner with.



KIKO VENTURES

Vestas Ventures





ENABLING AUSTRALIA'S ENERGY TRANSITION

Initiatives focussed on sovereign manufacturing capability for renewable energy infrastructure

Plate Processing

- In operation
- Highly accurate laser and plasma processing capability

Plate Mill Modernisation

- Under assessment
- Increased efficiency and capability; additional heavy plate processing line

Wind Tower Fabrication

- Under assessment
- Industry advocacy to support third-party wind tower fabrication capability

PKSW Pipe and Tube Mill

- Under construction
- Ability to produce structural members for large-scale solar tracking assemblies

Solar Componentry

- Under assessment
- Heavy roll forming for large-scale solar tracking assemblies



**PORT KEMBLA
HYDROGEN HUB**

**H2 TRAINING + SAFETY
DAY #2**

28 February 2023





**PORT KEMBLA
HYDROGEN HUB**

**H2 TRAINING + SAFETY
DAY #3**

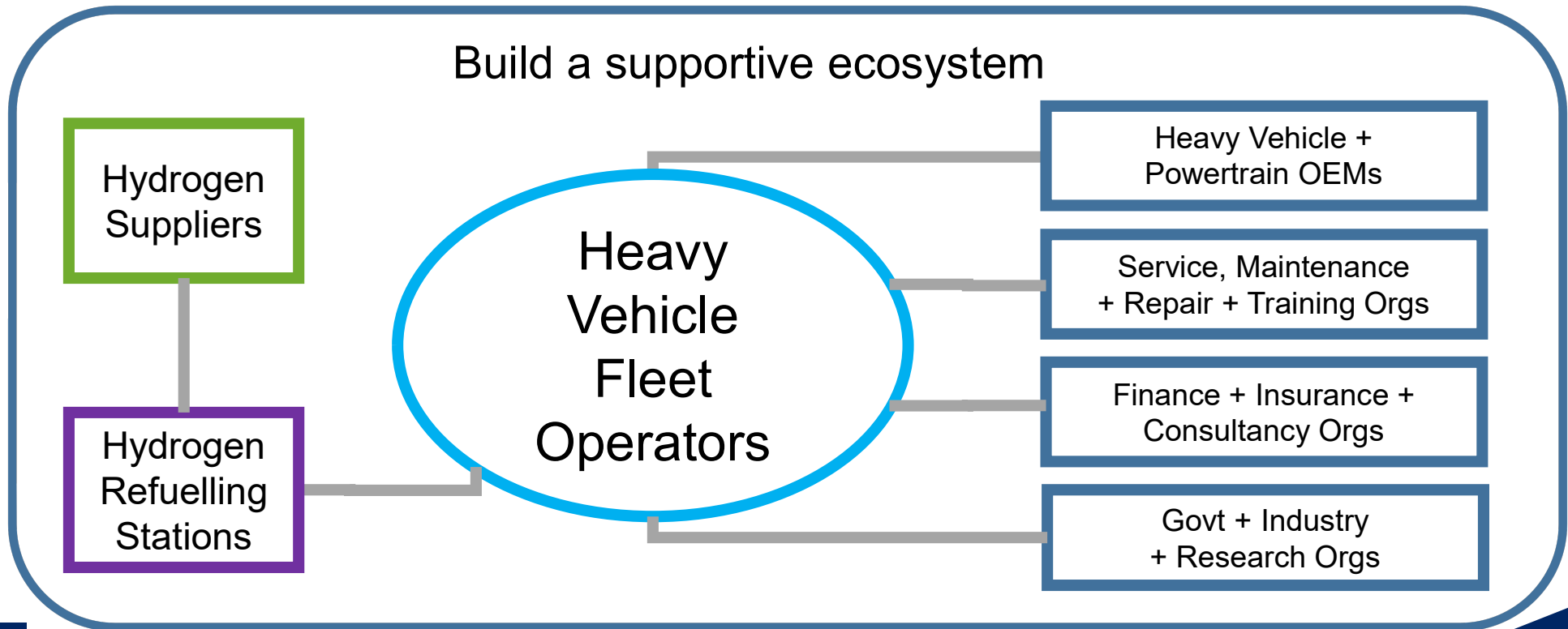
16 November 2023



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H2 Future Mobility Cluster

Heavy Vehicle Fleet Operators are the **core members** of the **Cluster**. Members also include a range of Heavy Vehicle and Powertrain OEMs, service, repair and training organisations, business and industry groups, finance and insurance providers, government, universities and research organisations. **Hydrogen Refuelling Station (HRS)** infrastructure is a **key enabler** supported by hydrogen suppliers.



Enabling infrastructure

Develop a network of commercial hydrogen refuelling stations (HRS) to support the transition to hydrogen powered zero emissions vehicles

- public multi lane stations
- on-site private fleet refuellers
- mobile refuellers
- train refueller



Illawarra Hydrogen Technology Hub



Project lead, BOC Limited
Located in Port Kembla.

- The project will supply green hydrogen to hydrogen refuelling stations for mobility, with capacity to power up to 40 heavy vehicles a day.
- Future developments will expand supply to decarbonise steel, glass, and cement production

Initial Phase

4t

Renewable hydrogen produced per day

10MW

Electrolyser capacity

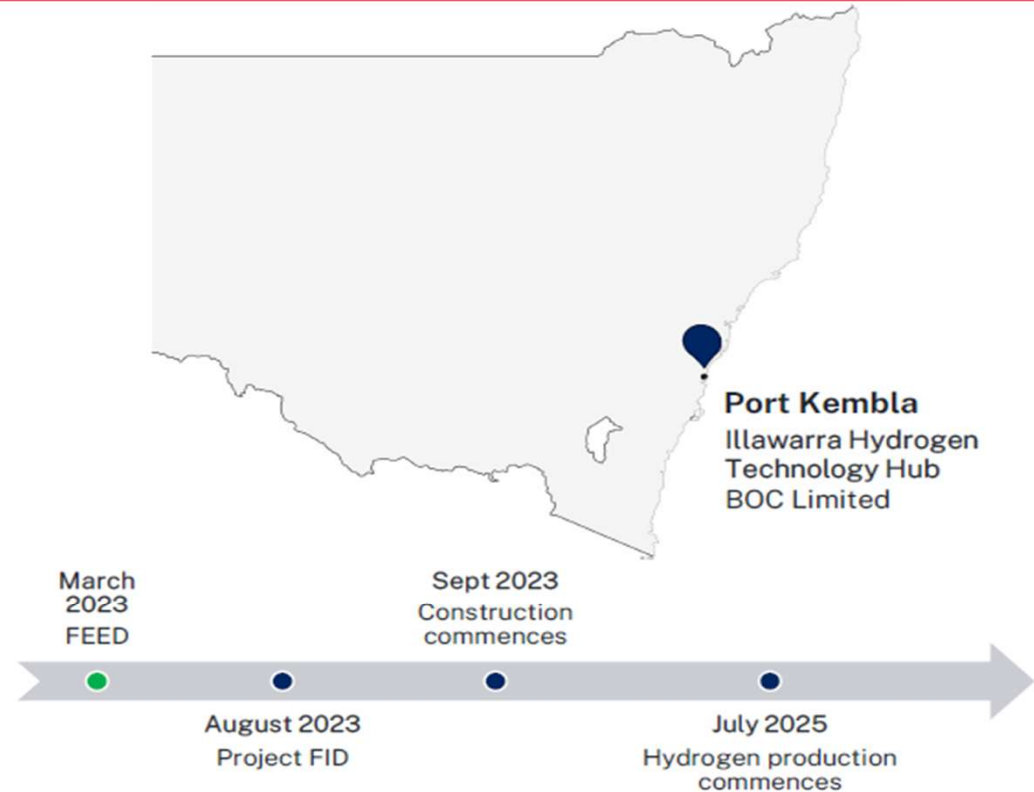
110

NSW Jobs

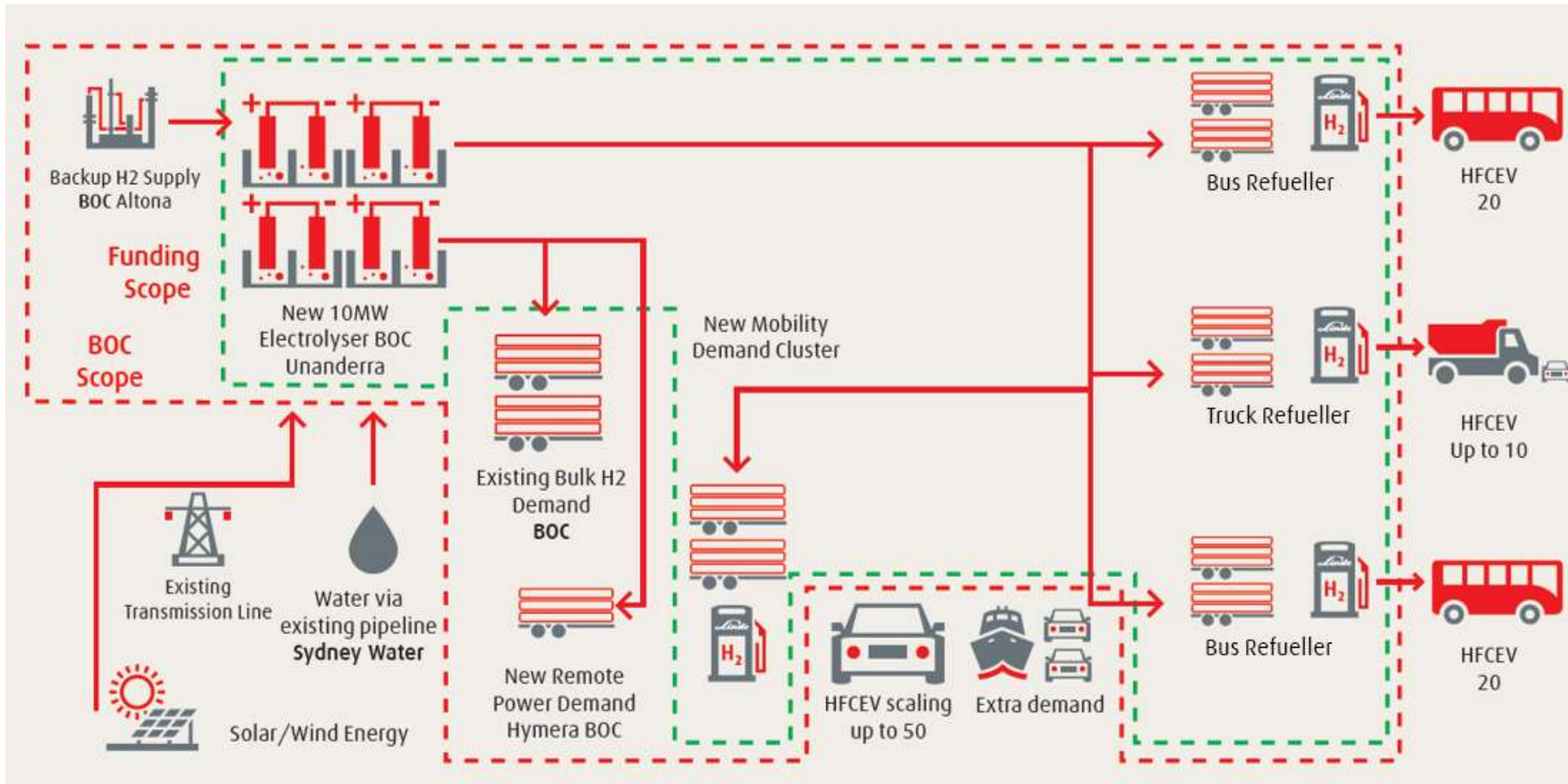
Project Aims

650MW

Electrolyser capacity



Phase 1 Scope for the BOC Illawarra Hydrogen Technology Hub



FCEV Technology - Deploying a Hydrogen heavy vehicle into service



Remondis Hyzon Fuel Cell

H2 Future Mobility Day #5 - 7 December, 2023

REMONDIS - INNOVATION

FCEV Technology - Deploying a Hydrogen heavy vehicle into service

- **REMONDIS** processes about 30 million tonnes of recyclable materials
- Moreover, the company is increasingly helping to advance the switch from fossil fuels to renewables by using biomass as a source of energy
- Global 1934 established in Germany 30+ countries, 4 continents 1000 plants and facilities 40,000 employees 11,000 company-owned commercial vehicles 200,000+ industrial and commercial customers 30,000,000+ people benefit worldwide
- As a global industry leader with the ambition and scale to make a difference, REMONDIS is proud to have brought the following innovations to the international waste and recycling sector: Our Lippe Plant is the largest industrial recycling centre in Europe – providing 1,400 jobs, recycling an extensive range of materials and delivering 336,900 MWh of energy to the German grid Using REMONDIS' patented TetraPhos® process, sewage sludge is thermally treated to produce phosphate-rich ash which is mixed with phosphoric acid to create valuable new commodities - recovering re-usable plastic granules and paper, cutting carbon emissions by 14,460 tonnes REMONDIS QR is processing 15,000 tonnes of waste mercury each year

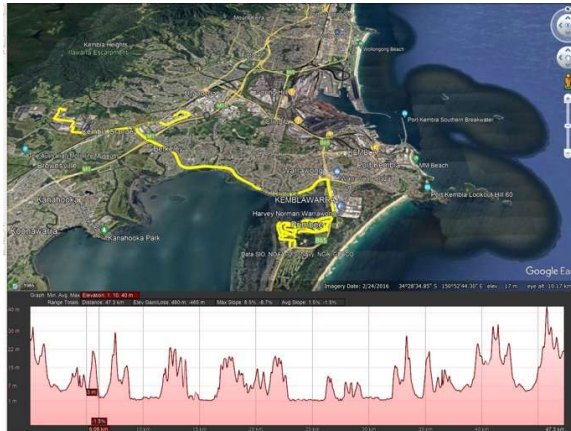
FCEV Technology - Deploying a Hydrogen heavy vehicle into service

Journey So far.

- October 2023 - Showtime
- November - Coregas filling station automated .
- Daily servicing
- Hyzon Remote monitoring. Assisting
- Training
 - Hyzon -Vehicle servicing
 - Coregas filling
 - Emergency services
 - TAFE
- Operational. No issues. Daily servicing

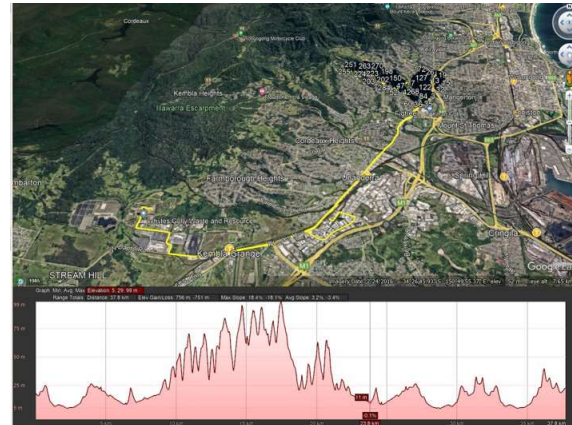


Ramp up Strategy – Bins # / Weight / Route profile / Running hours



Test Route #1

Bin Pick ups – **531 bins**
Mass – 5100kg
Distance – 47kms
Grade – 1.5% Average, peak 8%



Test Route #2

Bin Pick ups – 484 bins
Mass - 4850
Distance – 40kms
Grade – 3% Average, **peak 18%**



Test Route #3

Bin Pick ups – 621 bins
Mass – **6000kg**
Distance – 30kms
Grade – 3% Average, **peak 15.9%**



Test Route #4

Bin Pick ups – 804 bins
Mass – **9200 (max)**
Distance – 45kms
Grade – 1.7% Average, peak 9.5%

Waste Collection Heavy Rigid FCEV Trial : Peak Full Day Run



1,208

Bins Lifted



11.7 t

Waste Collected



2,310 m

Max positive elevation



87 %

% H2 tanks used



9.2 hrs



1.69 kg/H2

100 bins lifted

1.74 kg/H2

per tonne collected

Waste Collection Heavy Rigid FCEV Trial : Average per day



786

Bins Lifted



7.8 t

Waste Collected



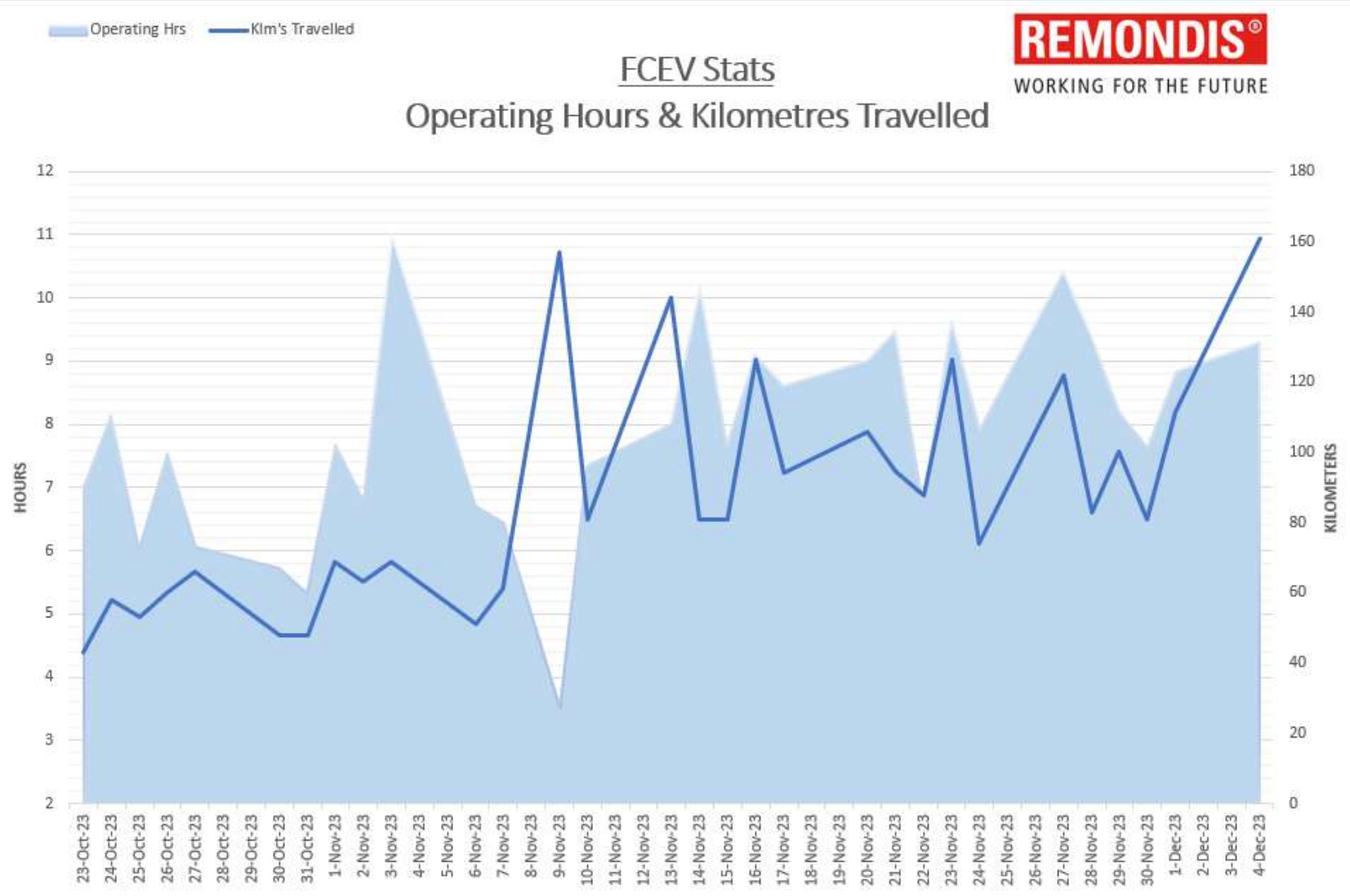
7.8 hrs

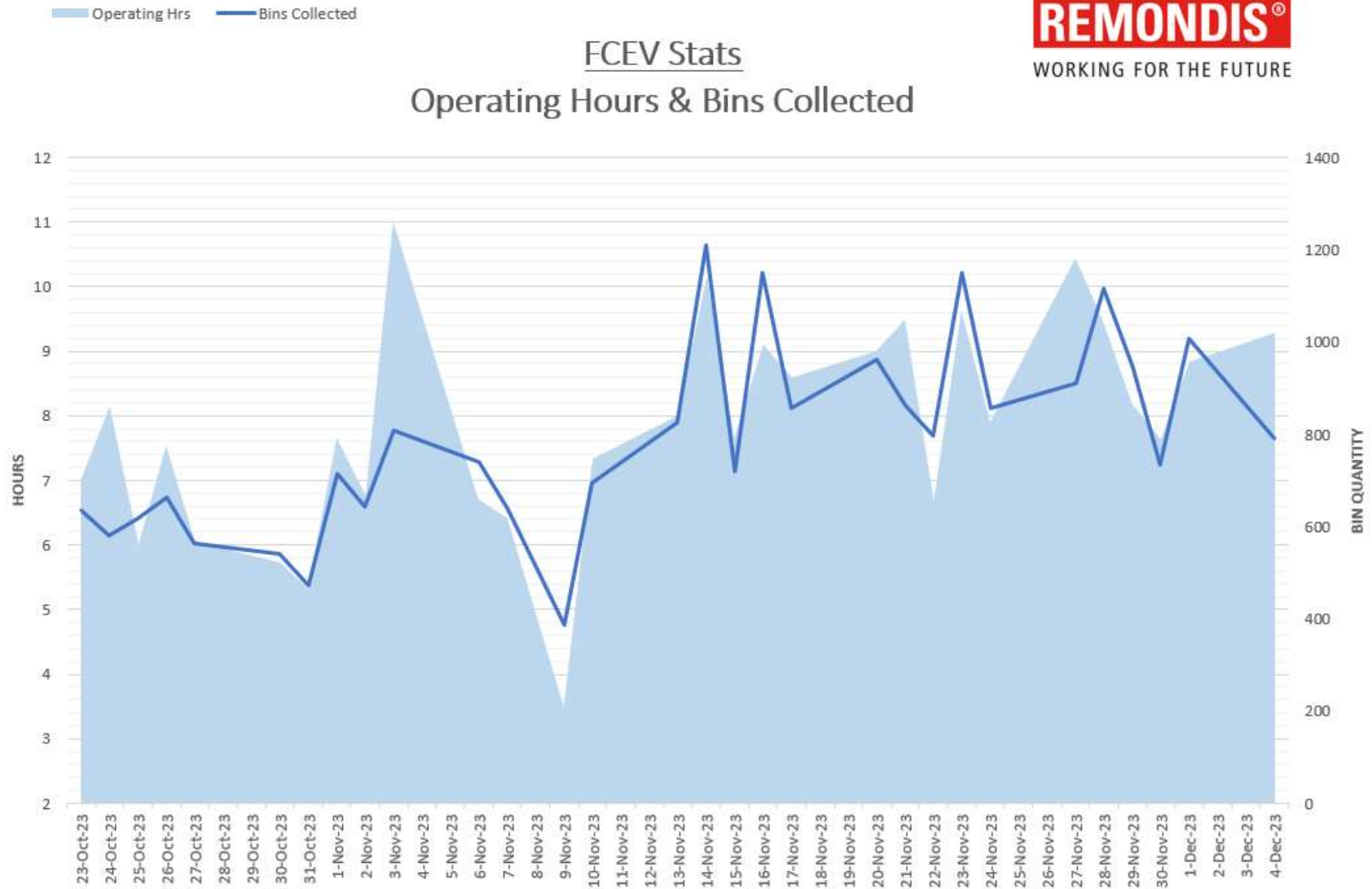
Truck Operating

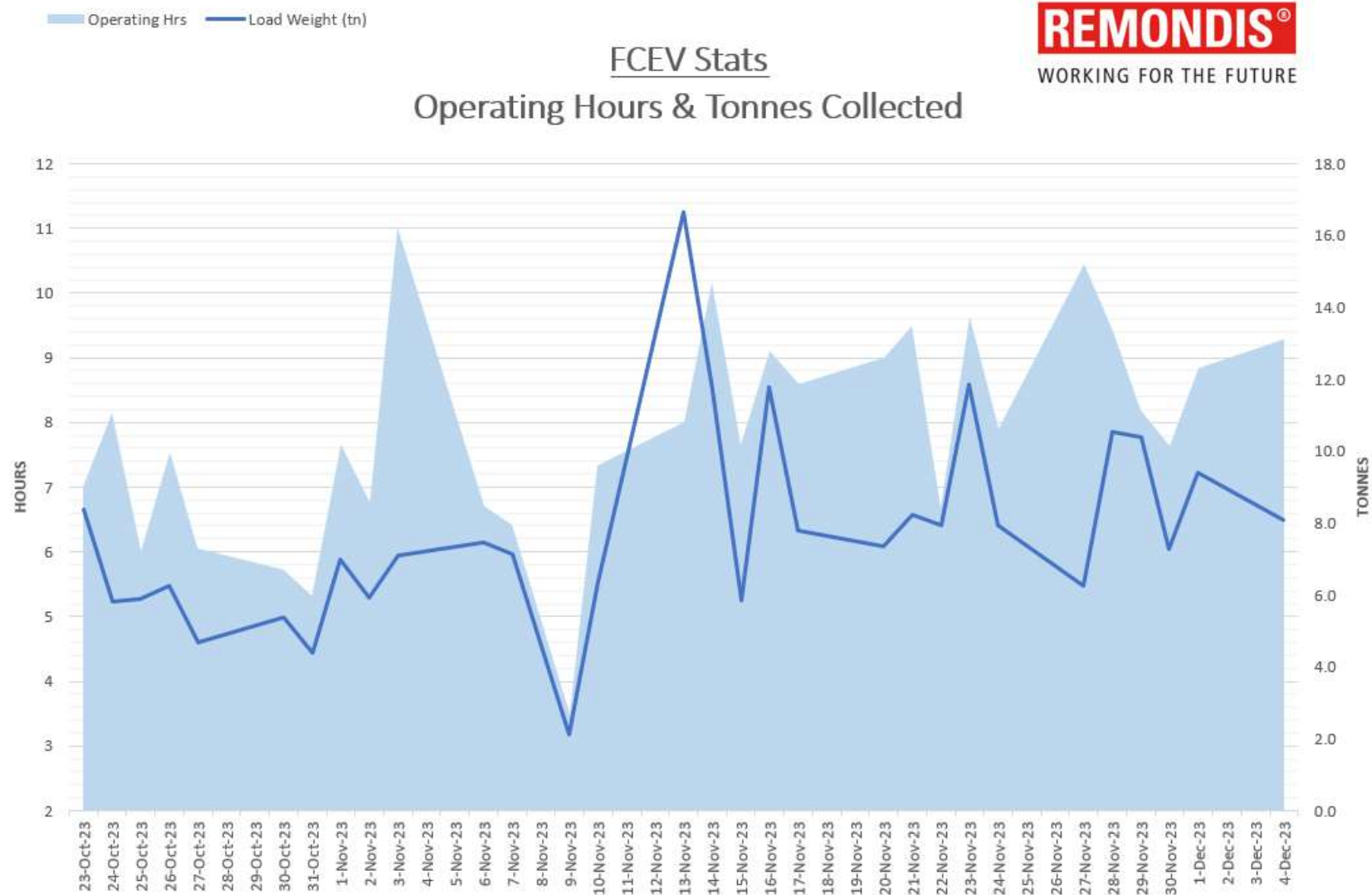


87 klms

Kilometres Travelled







Cumulated KPIs as of Dec 1st, 2023



22,975

Bins Lifted



192 t

Waste Collected



2,057 kms

In operations



2,310 m

Max positive daily elevation



237.8

FC Hours



400 kg/H2

Used



1.1 tonne

CO2 reduction

REMONDIS HYZON ■ Deploying a Hydrogen heavy vehicle into service

Lessons learnt.

- A close common ground relationship is important.
- Willingness to share technical information will produce the best possible product. In Build and operation.

Future Plans

- Remondis will supply their customers FCEV on request.
- The replacement of diesel vehicles will be customer driven.

TEAM Hyzon



Team REMONDIS



REMONDIS Wollongong

Zero Emission Waste Collection is a result of teamwork and support

Sincere Thanks.

- NSW Govt - Port Kembla Hydrogen Hub. - Nigel and Leanne
- Hyzon – Guillaume, Luke, Stacey and Team
- Coregas – Wodek and entire Team.
- TAFE NSW

Merry Christmas

- We wish everyone a Safe and Merry Christmas and look forward to the escalation in the commitment to reduce CO2 emissions.



**H2
Future
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- 7 December
2023

Questions?



H2ICE Technology

Commercialising UNSW Engine Lab research



Professor Shawn Kook
University of New South Wales (UNSW)
Co-founder and CTO, DeCarice



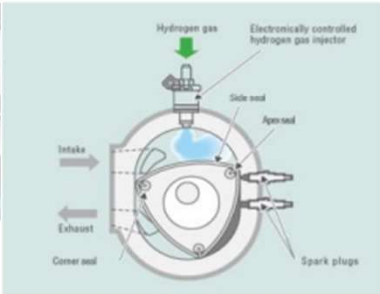
Patented Hydrogen-Diesel Direct Injection Dual-Fuel System

Hydrogen internal combustion engine (H2ICE) development plans

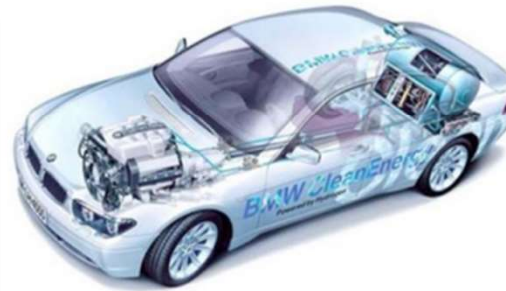
- I shared this exciting news at Future Mobility Day #3 back in 2021.



Ford Model U (2003)



Mazda RX-8 H2 RE (2003)



BMW Hydrogen 7 (2009)



Toyota Corolla H2ICE (2021)



JCB Hydrogen Excavator (2020)



AVL-Westport Dual-Fuel Engine Development (2021)



MAN stationary engine application with 20% H2 in Dessau-Rosslau (2021)



MTU's H2 engine development roadmap (2021)



CMB.TECH H2 Truck 2.0 (2021)



Caterpillar power generator development plan (2021)



Cummins truck engine development plan (2021)

New H2ICEs introduced in 2023

Toyota HiACE test operating in Melbourne.



Cummins truck engines



Caterpillar C13D off-highway (3 year development plan)



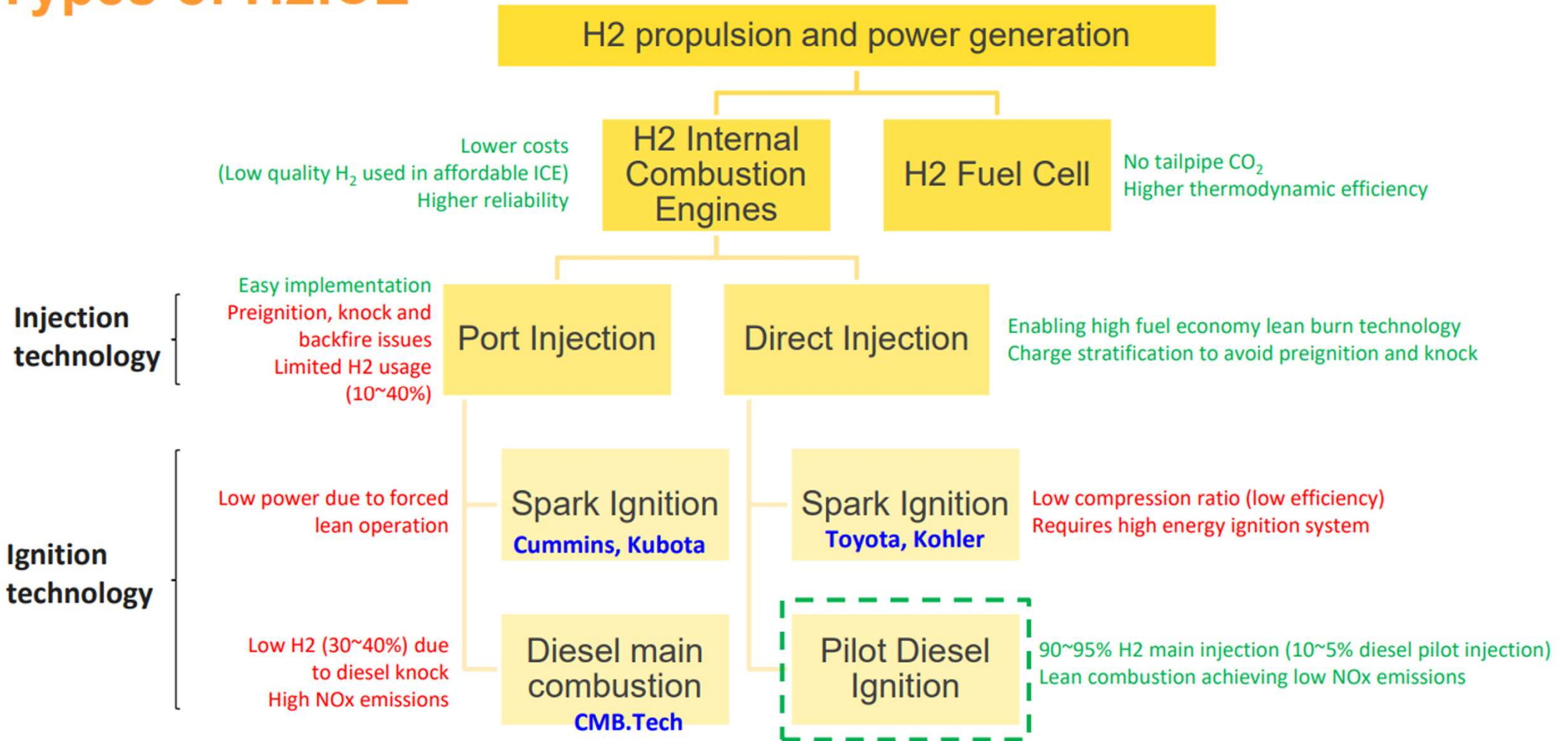
Kubota engines



Kohler engines

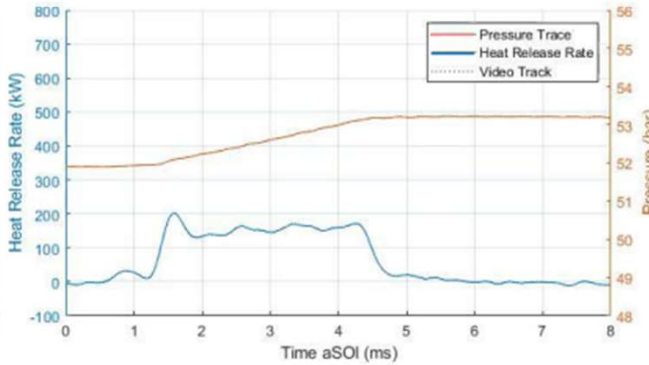
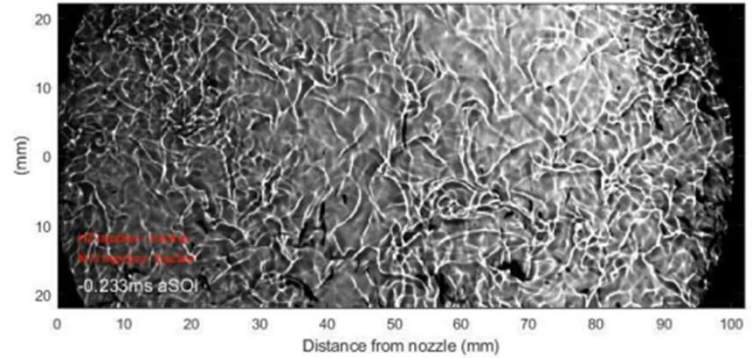
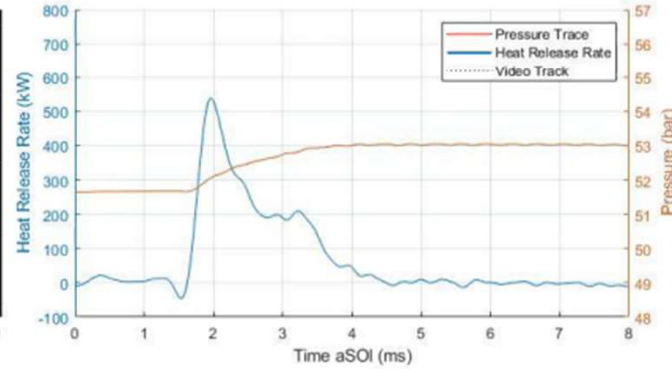
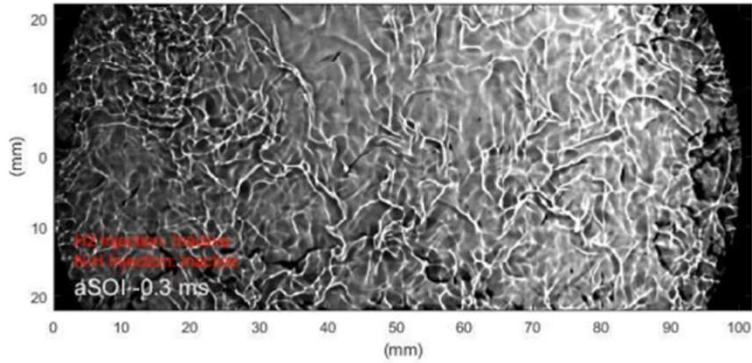


Types of H2ICE



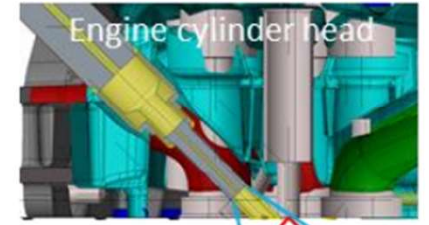
Hydrogen main fuel and pilot diesel ignition

High power/high efficiency operation mode (Hydrogen first and diesel ignition later)



Low NO_x operation mode (Diesel first and hydrogen main fuel later)

Engine demonstrations and patent



Hydrogen gas direct injection
Liquid diesel direct injection



0.5-litre/cylinder single-cylinder engine



1-litre/cylinder single-cylinder engine

Engine dynamometer operation

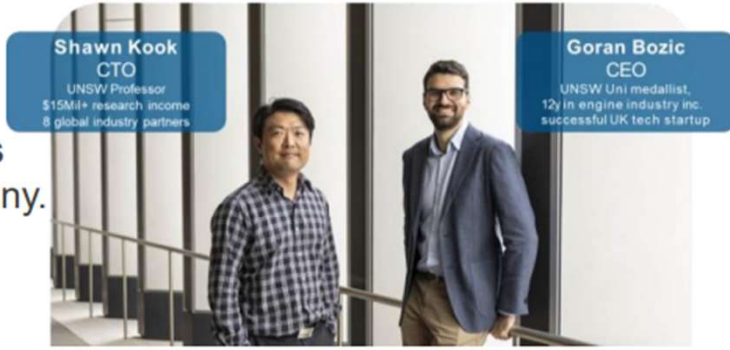


Commercialisation



Towards **DECAR**bonised **I**nternal **C**ombustion **E**ngines

- DeCarice has been founded as a UNSW spinout company.
- DeCarice has acquired the commercial IP.



Medium-duty diesel engines



In-field demonstration in 2024

- Medium-duty engines with 1.0~1.5 litre/cylinder
- Targeting Q1 2025 for the first on-process deliveries.

Heavy-duty diesel engines



Scale-up research

- Heavy-duty engines with 2.0~3.0 litre/cylinder are being developed.
- Research project co-funded by Rio Tinto and the Australian government's Trailblazer program

<https://decarice.com.au/>

Follow us on



R&D
Technology developed
at UNSW Engine
Research Laboratory

**Pre-
2023**

Scoping
Customer discovery,
requirements setting,
business planning

UNSW Founders
Climate 10x
Accelerator

2023

Volume Repower

Customer engine
conversions, primarily
following on with
demonstrator partners

2025+

2024

Demonstrators

In-field demonstrators
in different applications
with select customers,
buildup of internal
capabilities

2027+

Scale-up

Stable processes,
demonstrable benefits and
cross-market viability,
portfolio and international
expansion

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Thank our speakers

Chris Wade - Remondis

Shawn Kook - UNSW



FOTON T5 EV Truck



H2 Future Mobility Day #5 Display

- Foton T5 EV Truck
- City Coast Services Tipper Body



- 5 years/200,000kms warranty
- 8 years or 300,000kms Battery Warranty
- 3,500 kg towing (braked)
- Reversing radar and camera
- VSP (Low Speed Pedestrian Warning System)
- Driver and front passenger air bags
- 24/7 roadside assistance
- Car licence or Light Rigid licence

Ready to go to work. Comfortably.



H2 Future Mobility Day #5 Display

- Hyzon Refuse Truck



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