

The background of the entire image is a photograph of a desert landscape at sunset. The sky transitions from a deep blue on the left to a vibrant orange and yellow on the right, where the sun is partially visible. The foreground consists of rolling sand dunes. In the center of the image, the logo 'LAVO' is displayed in large, white, sans-serif capital letters. Below it, the words 'FOR LIFE' are written in a smaller, white, sans-serif font. A small trademark symbol (TM) is located to the upper right of the 'O' in 'LAVO'.

LAVO<sup>TM</sup>  
FOR LIFE

Distributed PV Green Hydrogen Production  
Regional Community Based Solar and Hydrogen Storage Solution  
Green Hydrogen is the New Dawn- Empower Regional Australia



# LAVO Introduction

LAVO and Family Brands-Owns the voice of sustainability and the world’s first green hydrogen brand -creating a new lifestyle and community. At LAVO, we aim to change the way people live with energy.

LAVO

World’s first lifestyle and technology brand  
powered by hydrogen  
LAVO™ System, LAVO™ H2Q,  
LAVO™ E-Bike and any future lifestyle products,  
app (targeted individuals, businesses and C+I  
applications)

HEOS

Large Utility Scale -Containerized Metal Hydride  
Hydrogen Storage Solution as the enabler for  
community decarbonation & decentralized energy  
solution and also for future hydrogen export –  
target large utility and industrial users

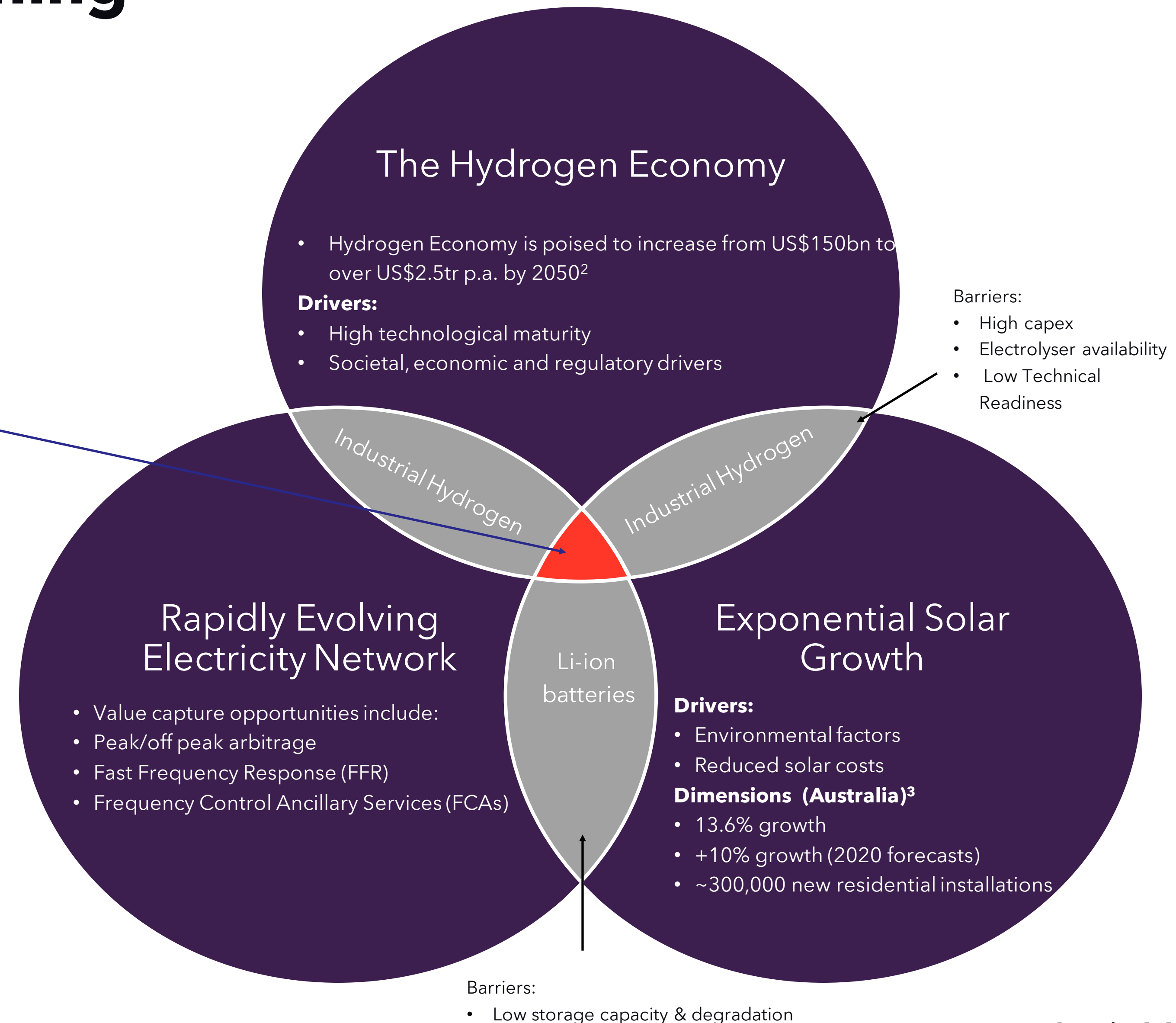
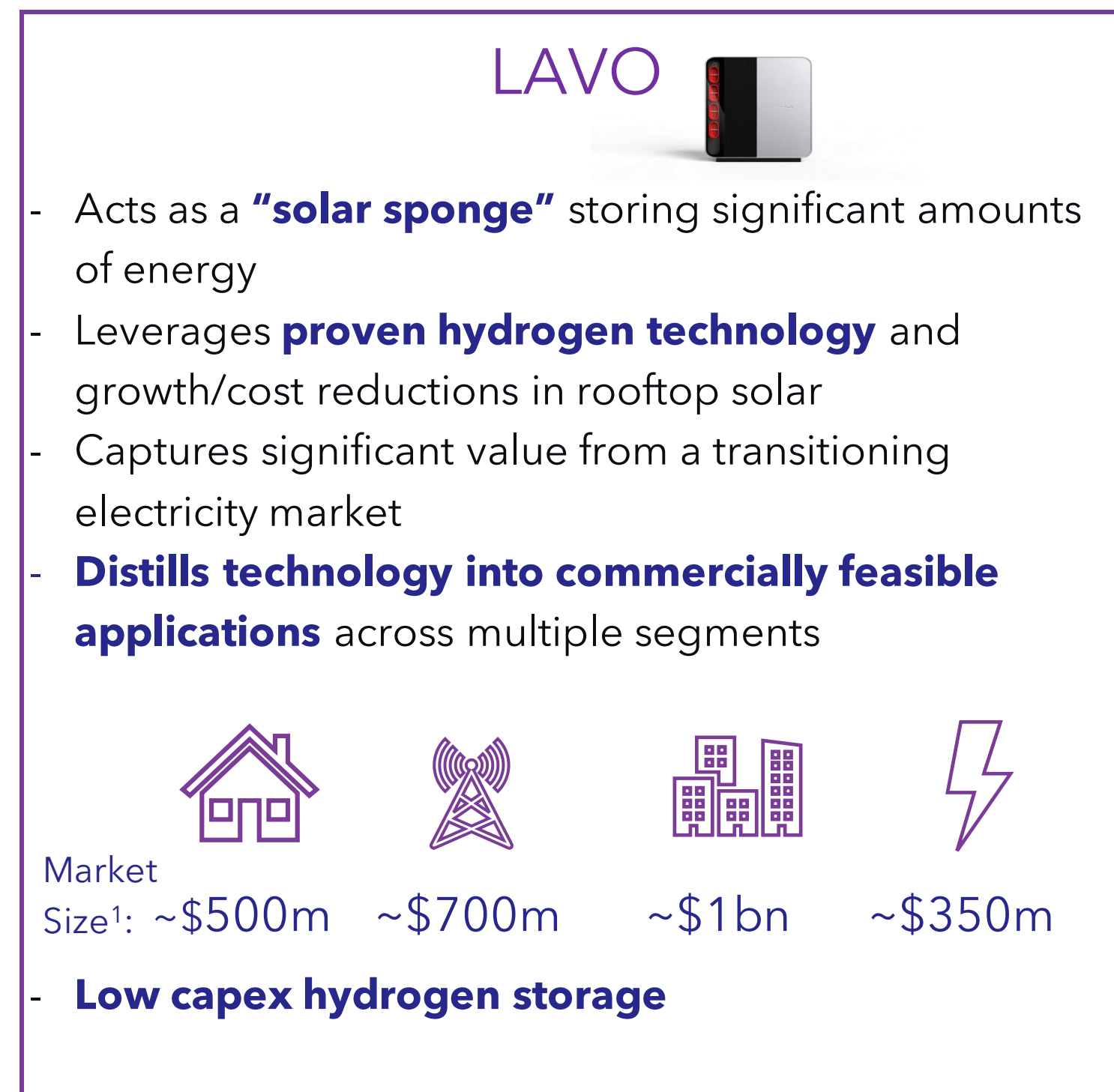
FRANC

Intelligence Centralised Asset  
Management System as optimizer for  
the performance of generation and  
storage assets

- Dedicated to powering a cleaner, greener future through hydrogen energy storage solutions, LAVO is building the next generation of energy storage in Australia using innovative technology that provides a more complete, versatile and sustainable solution.
- LAVO is the only commercial-ready hydrogen storage technology in the world designed for everyday use by residential homes and businesses and has secured its position as a genuine pioneer in the sector.
- It generates renewable energy transforms water into oxygen and hydrogen. Patented metal hydrides act as a “solar energy sponge” to store the hydrogen safely. The hydrogen can then be passed through a fuel cell, creating water for recycling and electricity to supply power to the grid and the community.
- LAVO hydrogen storage system, combined with Lithium ion batteries, supports the grid in harmony, keeping the supply strong and steady, but always ready for spikes in demand...Our green hydrogen energy can also be transported and sold to local businesses, such as dairy farms, replacing reliance on expensive sources of power, such as diesel.
- This would also be exported as a green fuel commodity in a similar way as to how we sell fuel today serving the growing global demand for renewable energy.

# LAVO'S Strategic Positioning

## Macro Drivers



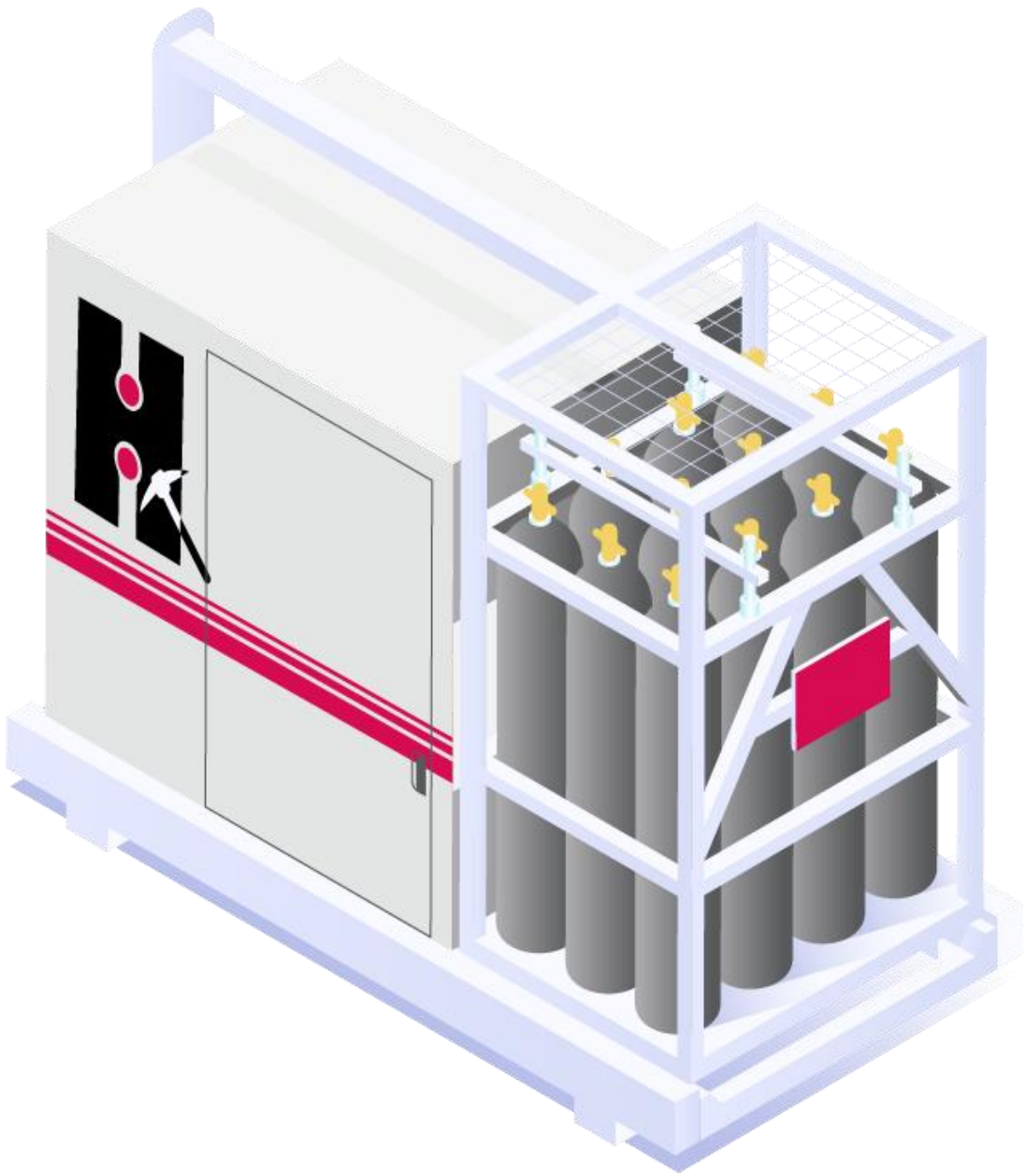
<sup>1</sup>See Appendix for underpinning assumptions

<sup>2</sup>Source: World Hydrogen Council "Hydrogen Scaling Up" 2017



# LAVO PRODUCTS

(Appendix for more details)



# Why Hydrogen and Why Now

*"Hydrogen is today enjoying unprecedented momentum. The world should not miss this unique chance to make hydrogen an important part of our clean and secure energy future."* **Dr Fatih Birol**, Executive Director of the International Energy Agency

## THE HYDROGEN ECONOMY<sup>1</sup>

- The world currently invests c.US\$1.7tr in energy each year, including US\$650bn in oil & gas, US\$300bn in renewables and c.US\$300bn in the auto industry
- In contrast, global Hydrogen Economy is poised to increase from US\$150bn to over US\$2.5tr p.a. by 2050

## FAVOURABLE POLITICAL LANDSCAPE IN AUSTRALIA<sup>3, 4</sup>

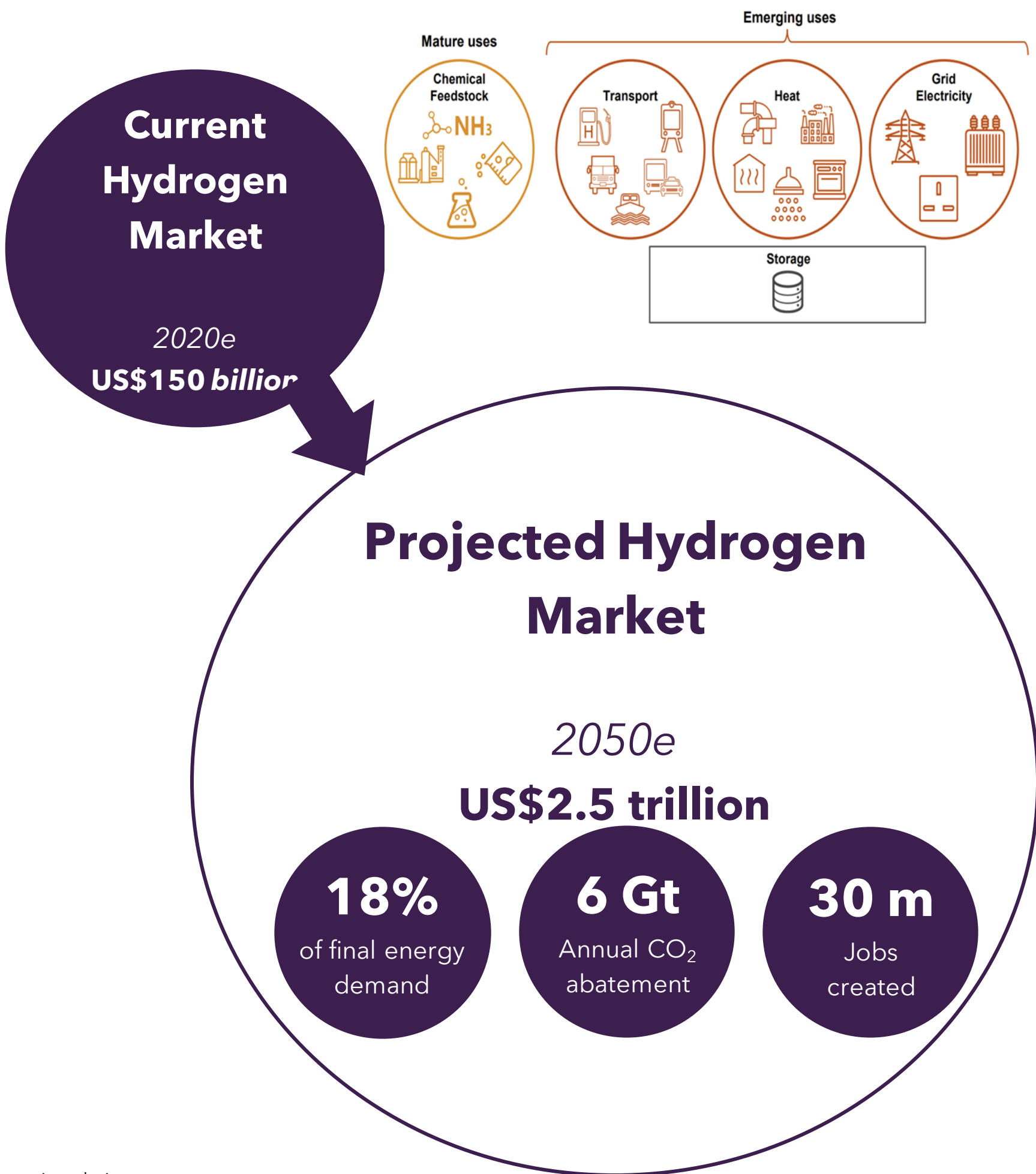
- A robust, government-backed National Hydrogen Strategy envisions a safe, innovative and competitive industry
- >\$146mn in government funding to primarily support R&D (\$68m) and pilot models (\$69m)
- \$1.9bn investment package to support businesses and regional communities

## DRIVERS FOR GROWTH

- Technological Maturity with a high Technological Readiness Level<sup>2</sup>, as well as storage capabilities
- Environmentally friendly zero greenhouse gasses from green hydrogen
- Societal/economic drivers and governmental regulation to decarbonise various sectors

## MEASURES OF SUCCESS

- Economic benefits and jobs in Australia
- Excellent hydrogen-related safety track record
- Robust, internationally accepted, provenance certification scheme in place
- One of top three exporters of hydrogen to Asian markets



<sup>1</sup>Source: World Hydrogen Council "Hydrogen Scaling Up" 2017

<sup>2</sup>Source: The Technology Readiness Level (TRL) Index is a globally accepted benchmarking tool for tracking progress and supporting development of a specific technology through the early stages of the innovation chain.

<sup>3</sup>Source: COAG Energy Council, "Australia's National Hydrogen Strategy", 2019

<sup>4</sup>Source: Prime Minister of Australia, "Investment in New Energy Technologies", 2020



# Embracing Green Hydrogen For Australia

Green hydrogen provides the opportunity to decarbonise the hard-to-reach sectors of our economy, where electrification may otherwise fall short.

We aspire to reach a day in which the resource that powers our heating and cooking, fuels our daily commute, and forms the cornerstone of our international exports is a carbon-free fuel source, safeguarding the stability of our environment while continuing to serve and benefit the Australian economy

To date, adoption of renewable energy targets have been at the forefront of curbing carbon emissions globally, with nations setting ambitious but increasingly deliverable targets of 30%, 50% or even close to 100% of power generation from renewable sources in the coming decades.

However, with only approximately one third of greenhouse gas emissions attributable to the electricity and heat sector, a further solution within the transport, chemical and industrial sectors must be pursued if we are committed to extending decarbonisation throughout the economy.

**The opportunity to realise this future as a reality lies with the production and use of green hydrogen, a versatile, storable, transportable, carbon-free fuel source.**

Source: PWC Report <https://www.pwc.com.au/infrastructure/embracing-clean-hydrogen-for-australia-270320.pdf> and <https://www.iea.org/reports/the-future-of-hydrogen>

# Potential for Hydrogen Fuel Cell in Australia

The time is right to tap into hydrogen's potential to play a key role in a clean, secure and affordable energy future. Hydrogen can enable renewables to provide an even greater contribution.

Fuel cells electrochemically combines hydrogen and oxygen, in order to create electricity, heat and water as a result.

In contrast to, batteries, fuel cells uninterruptedly produce electricity as long as the source of fuel is provided. Fuel cells don't consume fuel, making the procedure quiet, contamination free, and up to a few times more successful than ignition innovations. A fuel cell structure can be a certifiable zero-emanation source of electricity when it uses hydrogen made from non-polluting sources, like water electrolysis process.

Hydrogen Fuel Cell market is forecast to reach \$45.34 billion by 2025, after growing at a CAGR of 65.86% during 2020-2025.

# Potential for Hydrogen Fuel Cell in Australia

Hydrogen's many uses will lead to demand from diverse geographies and sectors

Federal Energy and Emissions Reduction Minister Angus Taylor said Australia had a competitive advantage to be a world leader in hydrogen exports.

"Australia's future hydrogen industry has the potential to generate 7600 new jobs by 2050, many in regional Australia, with exports estimated to be worth around \$11 billion a year." Mr Taylor said

## **The major opportunities of Hydrogen Fuel Cells Market are as follows:**

- Rising concern regarding environmental pollution across the world
- Government initiatives to promote the use of green energy

## **The major driving factors of Hydrogen Fuel Cells Market are as follows:**

- Increasing demand and need for clean energy
- Growing adoption of electric and hybrid vehicles
- Reduced dependency on non-conventional energy sources
- Knowledge and awareness level regarding hydrogen cells has increased

Source: Hydrogen Fuel Cell Market Research and MENAFN



# Potential for Hydrogen Storage and Export in Australia

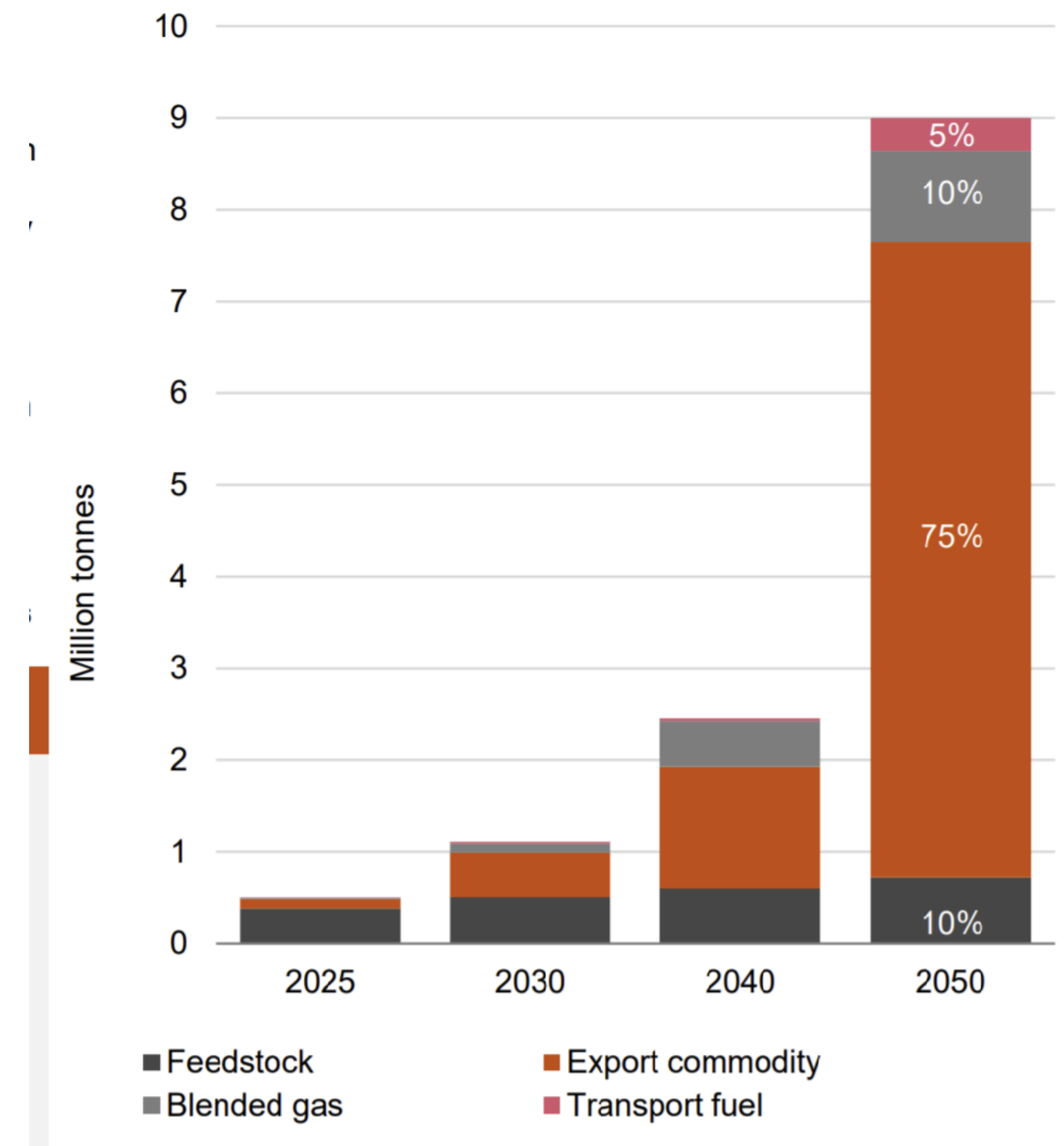
## The emerging demand for green hydrogen

- The global hydrogen market is expected to boom between 2030 and 2050, but it is necessary for Australia to invest domestically today to anticipate this growth.
- The largest emerging roles which hydrogen is expected to play in the future of Australia's domestic energy system is as a blended gas and as a transport fuel, but its growth will present many investment opportunities across numerous sectors.
- Japan, Germany, South Korea and other markets have set ambitious hydrogen targets, presenting a multibillion-dollar opportunity for the Australian export industry in the long-run.

## Australia can lead the global shift to hydrogen:

- ✓ Abundant renewable energy potential at low cost - integral for the development of industrial-scale green hydrogen;
- ✓ Strong existing trade links - well-positioned geographically for the high hydrogen demand economies of Japan, Germany, South Korea, Singapore and other markets;
- ✓ Proven track record in industrialising commodity production - at the forefront of natural gas production and trade, with well-developed regulatory, safety and market infrastructure.

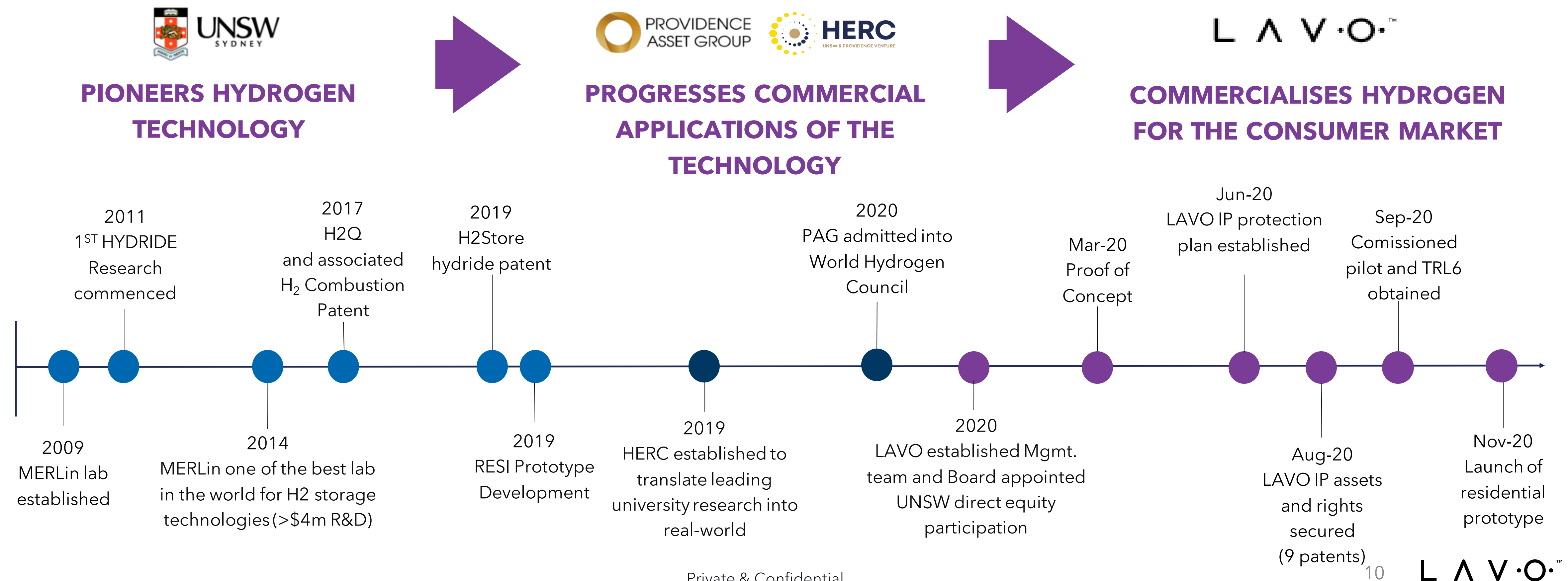
Australia's hydrogen end uses<sup>17</sup>



Source: PWC Report <https://www.pwc.com.au/infrastructure/embracing-clean-hydrogen-for-australia-270320.pdf>

# LAVO's Technology - The Evolution

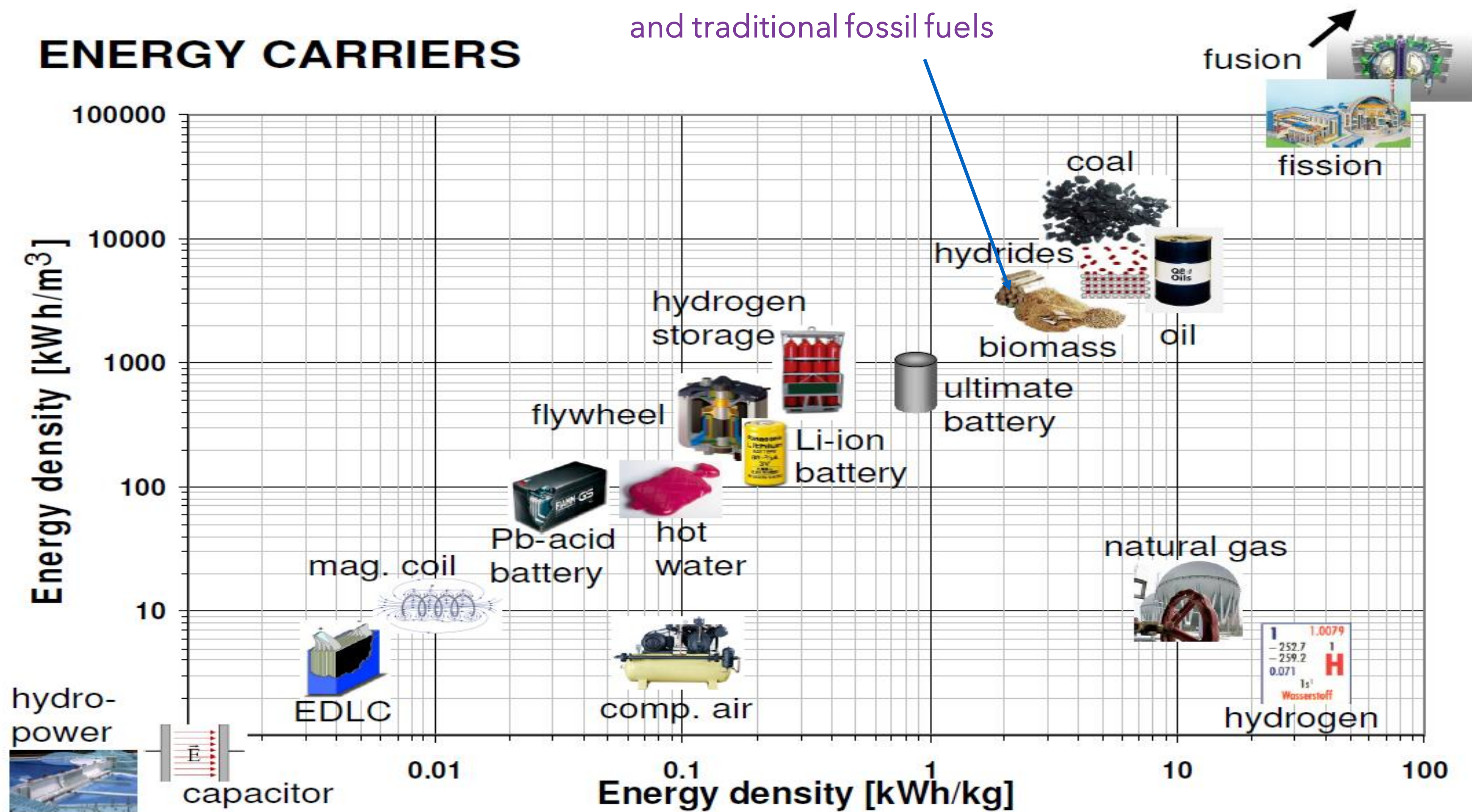
The world's first hydrogen energy storage system developed from Global Leading Research Pedigree





# LAVO's Patented Hydride Technology

LAVO fills this gap between Batteries and traditional fossil fuels



# Comparing the LAVO Hydride to H<sup>2</sup> Alternatives

	LAVO HYDROGEN HYDRIDES	PRESSURISED HYDROGEN PATHWAY AT 700 BAR	LIQUIFIED HYDROGEN	THE AMMONIA PATHWAY	OTHER METAL HYDRIDES
SUSTAINABLE STORAGE SOLUTION	Metal alloys are non-toxic, 100% recyclable ✓	High management and equipment cost	High management and equipment cost	Issues on generating hydrogen back	Rare metals, mass production and sustainability are issues
EFFICIENT STORAGE SOLUTION	20,000 charging/discharging cycles with very little losses in storage cycle ✓	N/A	30% lost in transport	Low efficiency	1,000 charging/discharging cycles
ENERGY DENSITY	12.6MJ/L ✓	5.6MJ/L	8.0MJ/L	15.6 MJ/L	Varies based on composition
LOW PRESSURE APPLICATION	30 bar ✓	700 bar	N/A	N/A	Varies based on composition
SAFE STORAGE STATE	Metal self-regulates the rate of hydrogen release, room temperature ✓	Extreme safety issues	Safety issues	Safety issues	Requires extra heat up to 350C to release hydrogen, e.g. for magnesium
CAPABLE OF DC SIDE INTEGRATION	Allows capture of renewable energy as DC electricity ✓	N/A	N/A	N/A	N/A



# Hydrogen Transport Options

Currently there are five technology options for the transportation of hydrogen for export:

**1. The liquefied hydrogen pathway**

*30% lost in transport, safety issues, high management & equipment cost*

**2. Pressurised hydrogen pathway at 700 bar**

*Extreme safety issues, high management & equipment cost*

**3. The ammonia pathway**

*Low efficiency, still a developing technology with issues on steam reforming*

**4. The methylcyclohexane (MCH) pathway**

*Fundamental research is needed for process to be viable*

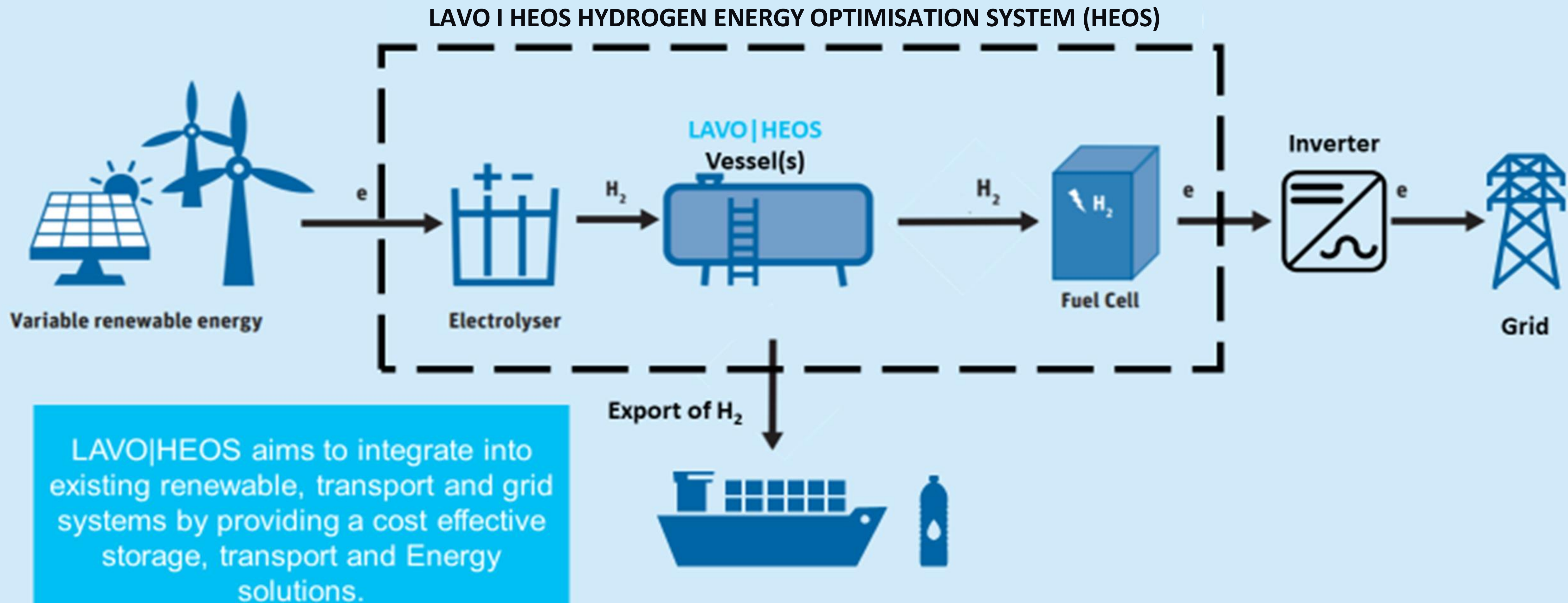
**5. LAVO|HEOS Hydrogen Hydrides – OUR SOLUTION**

# LAVO|HEOS Hydride Storage - Key Highlights

- **Sustainable Storage Solution** – The metal alloys are non-toxic and can easily be recycled. This provides a significant sustainability solution over the likes of Li-ion.
- **Efficient Storage Solution** – Storage hydrides have 20,000 charging/discharging cycles with very little losses in storage cycle.
- **Enabler of Hydrogen Export** – LAVO|HEOS vessels have an energy density of 12.6 MJ/L – compared to 5.6MJ/L for liquefied/compressed hydrogen – an increase over the current viable solutions.
- **Low Pressure Application** – Lower operating pressure (30bar vs 700bar). This removes technical issues such as pressure certification, testing and embrittlement.
- **Safe Storage State** – Metal self-regulates the rate of hydrogen release. This prevents a catastrophic release in the event of a vessel leak.
- **Capable of DC Side Integration** – Allows capture of renewable energy as DC electricity, including energy which would previously be lost. Provides cost reductions from duplication of inverters.
- **Pre-commercialisation costs are comparable with existing technologies** – Initial studies indication comparable life time costs with other battery technologies.



# LAVO|HEOS Large Scale Scope

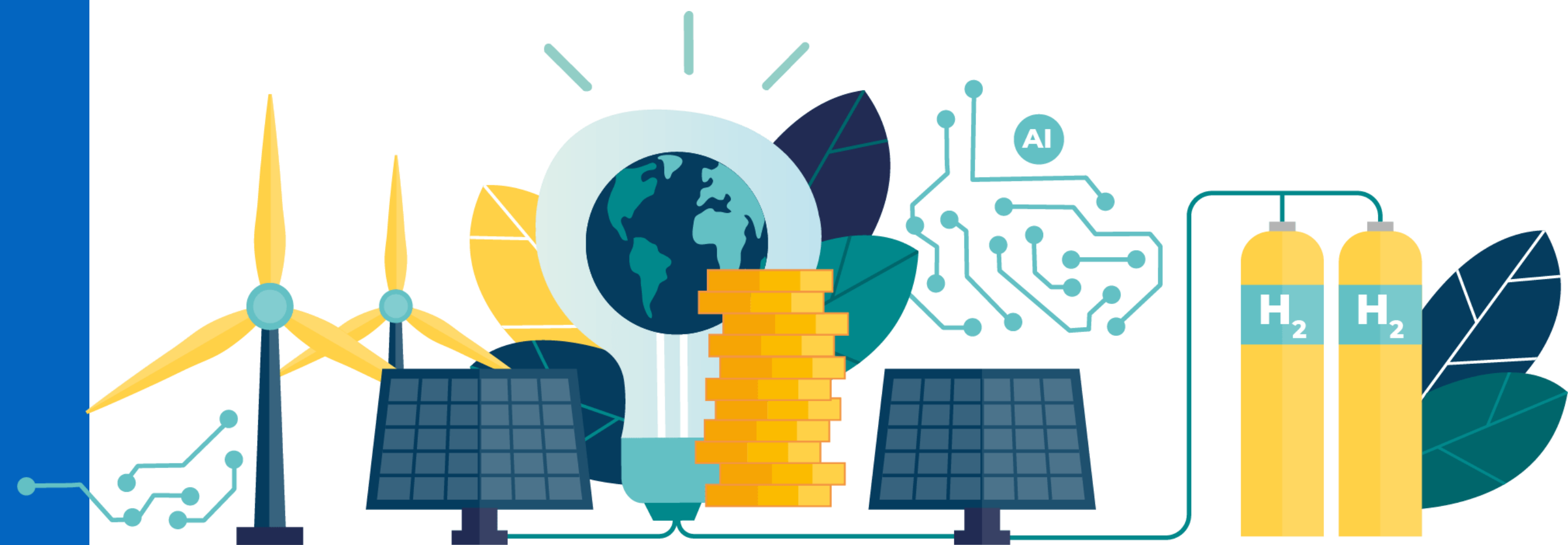


# Demonstration 1 Hydrogen Energy Storage System, VIC

The CRC-P project will deploy pilot storage on Stanhope Community Solar Farm in VIC to demonstrate:

- ✓ Delivery of a truly sustainable and dispatchable energy integration solution
- ✓ Accelerated commercialization of new hydrogen technologies. The use of hydrogen technology to store renewable energy in this way will be a world first and will allow for Australia to own a large share of the global hydrogen market.

This project will provide a practical demonstration of LAVO|HEOS's technology and potential; including integration with utility grade electrolysers and fuel cells



LAVO|HEOS are participating in a CRC-P project with key industry players including, UNSW, UTS, CSIRO, GHD, Powerlink, Ausgrid and SunGrow.

This project aims to solve energy problems of today and facilitate a transition towards a sustainable, reliable, secure and cost-effective future in energy.



# Demonstration 2 Manilla Community Solar Project, NSW

We have partnered with the Manilla Community in regional NSW to deliver a local solar project aimed at reducing electricity cost using solar and LAVO|HEOS storage for firming.

Under this project, the community will be offered both reduced electricity costs and separately an opportunity to invest in the project.

On success of completion, the Manilla project will reduce local electricity costs and deliver sustainable regional jobs.





# Project Benefits

## Energy Storage/Firming from Hydrogen

## Hydrogen Production Benefits

### Duel Technology Offering

Li-ion batteries project exceptional grid stability (sub 100ms) services, and are cost-effective for FCAS and arbitrage for sub-6min intervals. On the other hand, hydrogen can provide bulk energy arbitrage at an affordable cost. This project is the first of its kind showing the grid-connected capability for hydrogen and lithium ion, showing grid benefits through the combination and integration of both technology sources.

### Regulated Services

QLD-NSW interconnector is a weak point in the NEM, with a simulated trip of the Tomago Smelter showing the need for additional grid stability measures. It is possible that similar negotiations to ARENA's ESCRI project could result in Yarranlea being able to lease regulated services of the HESS and BESS.

### Grid Firming

With increasing numbers of intermittent renewable energy generators connecting to the NEM, multi-technology solutions are required to combat grid issues such as solar ramp-rate volatility and provide cost-affordable green firming potential. This project is a perfect example of how this can be achieved using established and emerging technology.

### Green Firmed PPA, Through Hydrogen

Hydrogen shows a pathway to bulk energy arbitrage in a way lithium ion cannot. Li-Ion batteries are driven by the lithium costs, proportional to the MWh storage. This is the opposite for hydrogen projects, with the HESS capable of 5 hours of energy storage allowing for a completely firmed PPA to be possible.

### Reducing Cost For Green Hydrogen

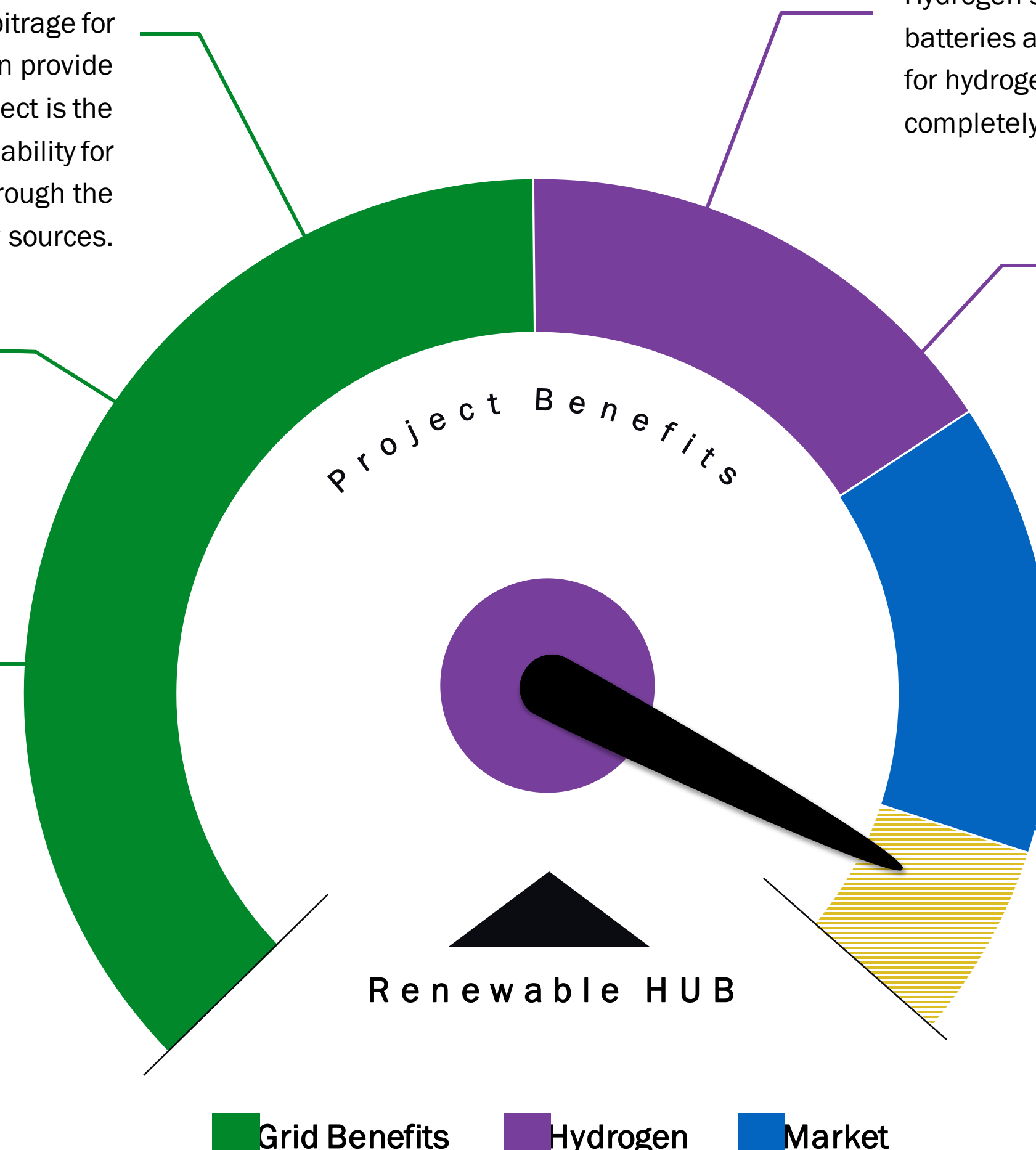
The deployment of 50MW of electrolyzers (both PEM and ALK) will be one of the largest of its kind in the world. This project will serve to continue to drive prices down for hydrogen generation in Australia.

### Building Green Hydrogen Demand

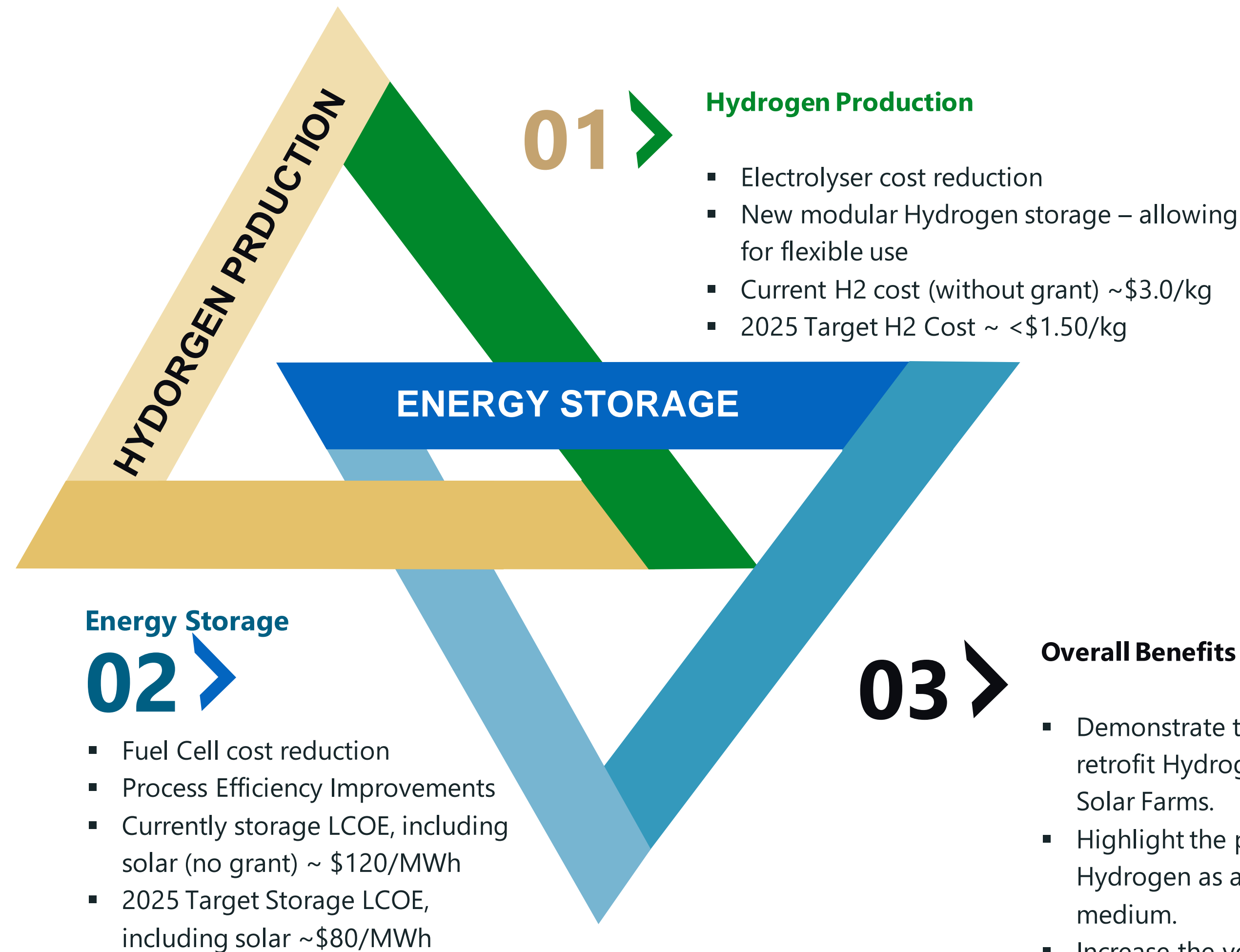
By building, launching, and delivering the hydrogen generation facility there is opportunity in coming years to use excess hydrogen for the refueling of a hydrogen bus fleet. It is the goal of the project to assist the Toowoomba city council in purchasing a hydrogen fleet and allow safe hydrogen transport to the city refueling station via H2Store's 20" containers.

### De-Risking Future Projects

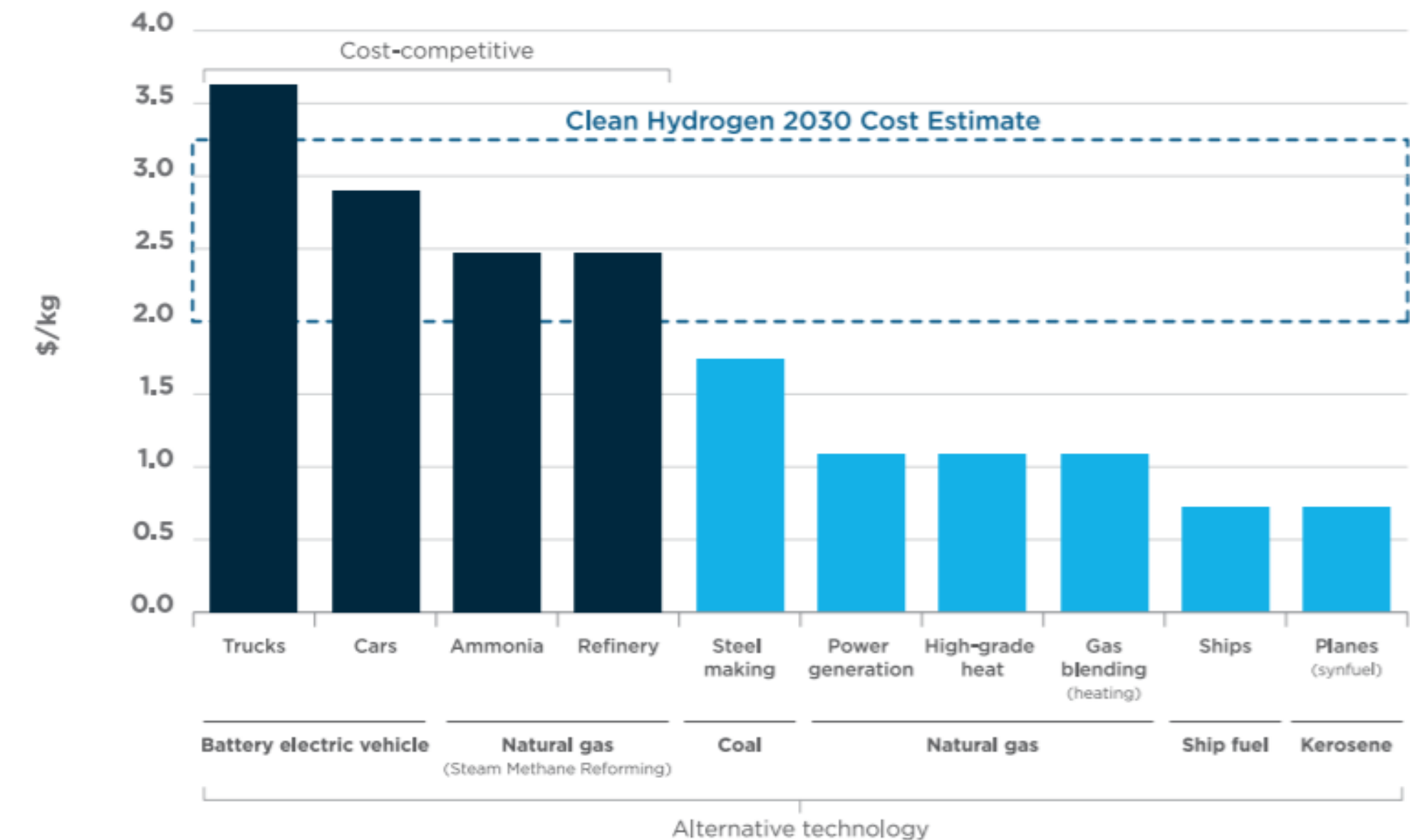
This project will serve as a flagship project, highlighting the importance of grid-connected fuel cells and projects of this type. Additionally, key industry partners such as AEMO will be brought along the journey with this project creating a template for more to follow.



# Targeted Project Outcomes



**Figure 1.3** Breakeven cost of hydrogen against alternative technology for major applications, in 2030.





# Nedstack and LAVO JV Potential for Hydrogen in Australia

With declining costs for solar PV and wind generation, building green hydrogen generation at locations with excellent renewable resource conditions could become a low-cost supply option for hydrogen, even after taking into account the transmission and distribution costs of transporting hydrogen from (often remote) renewables locations to the end-users.

Harnessing energy from the universe's most abundant element is not a new concept, but we can do much more to produce and use hydrogen in a way that maximises its potential to transport and use carbon-free energy across multiple sectors

As emerging sectors and international opportunities increase, the demand for clean hydrogen, production will scale-up, reducing costs and attracting further investment.

Significant business volume has been building up in the Nedstack and LAVO order portfolio for the Australian market and a commercial pipeline is rapidly building up. The Australian hydrogen economy is also a green jobs program which rewards local content to develop new regional infrastructure and with new job activations.

In developing strategic growth with Providence Asset Group (PAG), Nedstack has committed to setting up local assembly with LAVO (on a JV basis) in Australia when significant business volume (>1k Stacks per annum) materializes which is scheduled to trigger in fiscal year 2021.

Along the process of supporting LAVO in building product maturity and commercial momentum, Nedstack has been working with LAVO and Springfield City Group at QLD state of Australia in finding land and developing an assembly hub for the anticipated JV.

Source: PWC Report <https://www.pwc.com.au/infrastructure/embracing-clean-hydrogen-for-australia-270320.pdf>

# Nedstack Introduction

Nedstack fuel cell technology B.V. (**Nedstack**) is a global PEM Fuel Cell market leader.

Nedstack is a fuel cell stack and power system manufacturer based in the Netherlands, which spun out from its former parent company – AkzoNobel – in 1999.

Among Nedstack's greatest achievements are the creation of the world's first megawatt sized PEM power system in 2011, the delivery of the world's longest-running PEM power system, which has accumulated 70,000 running hours, and the installation of the world's largest PEM power system operating today.

In relatively quick order, Nedstack has established itself as a true global champion in the safety-critical, high-power PEM fuel cell domain.

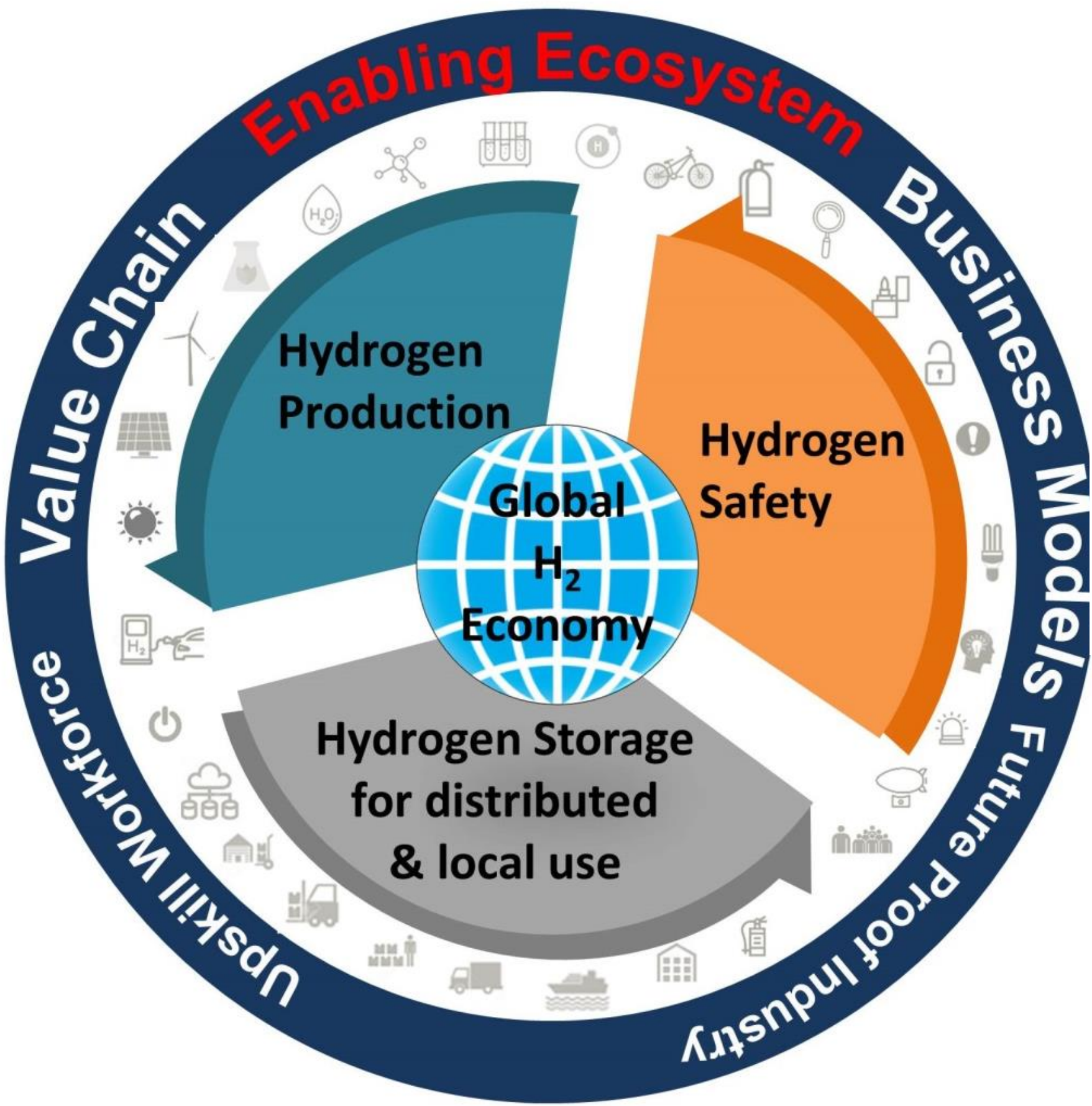
While most of the PEM industry has been committed to delivering excellence in power-density based on automotive supply chain integration, Nedstack has instead prioritised the levelised cost of energy (LCoE) of PEM solutions and pursued a leadership role in the design and delivery of industrial-grade systems.

Consequently, its PEM power plant solutions – which are commercialised under the PemGen® label – offer lengthy service intervals, 20 years of in-field use, and excellent efficiency.



# LAVO- ARC Training Centre for the Global Hydrogen Economy

To train and develop world class hydrogen technology engineering professionals with relevant skills and expertise to meet the emerging and rapid growth of the Australian and global hydrogen industry; and continue to build on Australia’s competitiveness with further innovation





LAVO™  
FOR LIFE

THANK YOU

# APPENDIX

## FIRST LAVO PRODUCT

True zero-emission, high capacity energy storage



### THE LAVO™ ENERGY STORAGE SYSTEM IS THE FIRST PRODUCT TO MARKET

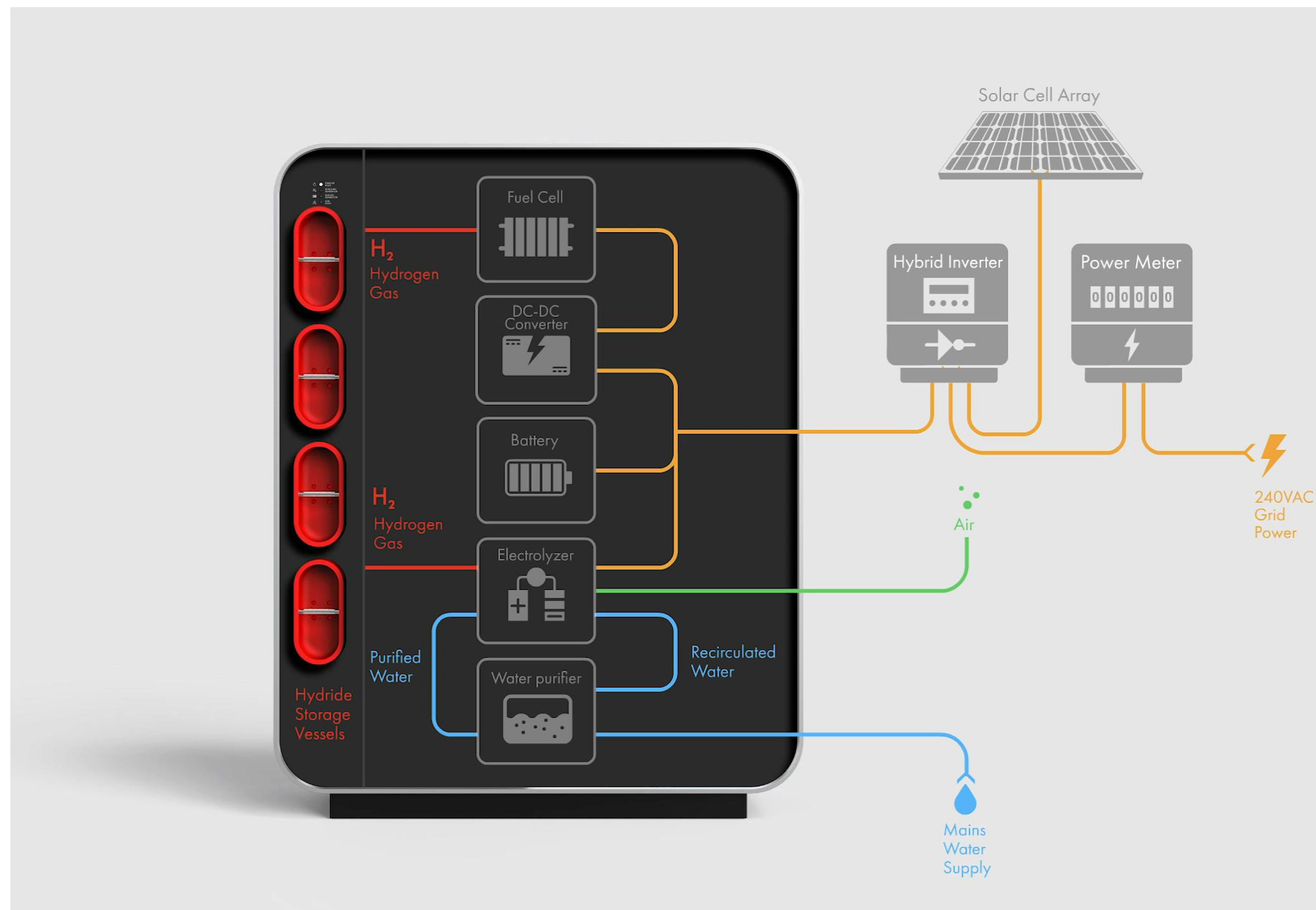
The LAVO uses innovative, patented metal hydride to produce batteries that last three times longer than lithium batteries at a similar price, while also being energy efficient, carbon neutral, safe, non-flammable, and with all components able to be recycled

### DESIGNED TO ACT AS A "SOLAR SPONGE"

- Harnesses the energy generated from the exponential growth in solar installations
- Multiple use cases
- High Storage Capacity - superior storage capacity 40kWh
- Long Life Span - 30 years
- Sustainable - lower environmental waste at the end of life
- Greater Return on Investment - strategic growth opportunities in targeted markets maximises investment returns



# HOW THE LAVO SYSTEM WORKS



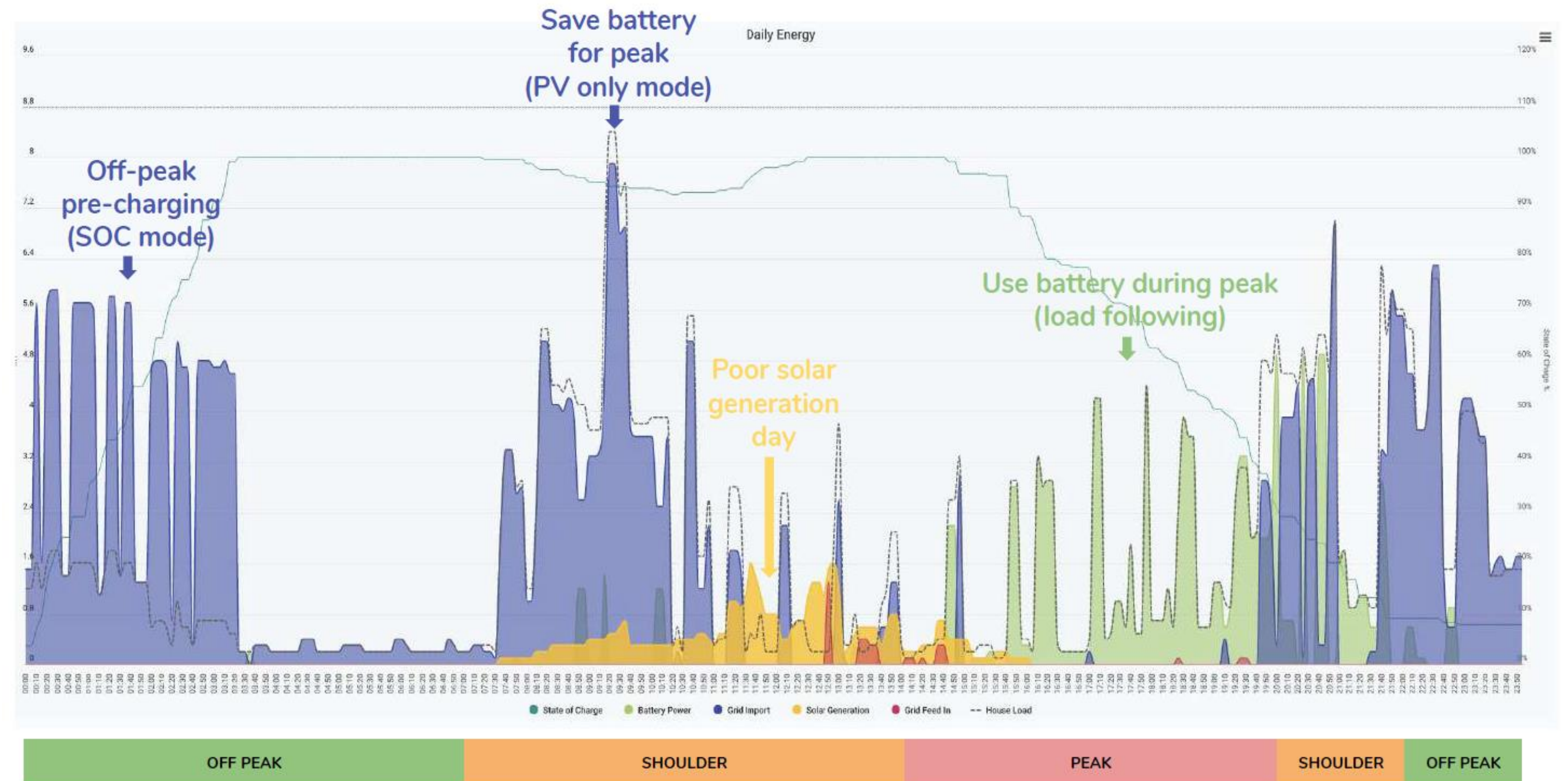
## LAVO INTEGRATES WITH STANDARD ROOFTOP SOLAR SYSTEMS.

1. **Acts as a "Solar Sponge"** to harness energy from renewable solar
2. **Convert Electrical Energy** through electrolysis
3. **Create Hydrogen** from water using an electrolyser
4. **Store Hydrogen** into a patented LAVO metal hydride
5. **Convert Hydrogen** to electricity via a fuel cell and discharges to the family home
6. **Control Safety**, operations and communications via digital control system

# AI OVERLAY OPTIMISES LAVO'S PERFORMANCE

Acquisition of a 40% stake in Evergen has facilitated the development of this technology

- Evergen Intelligent Control optimises solar and battery system performance, enabling homeowners to take control of their energy costs and impact on the environment.
- The technology also enables smarter energy by orchestrating large fleets of batteries to enable Virtual Power Plants. This ensures a resilient and decentralised energy system of the future and drives benefits for consumers, businesses, network operators and utilities.

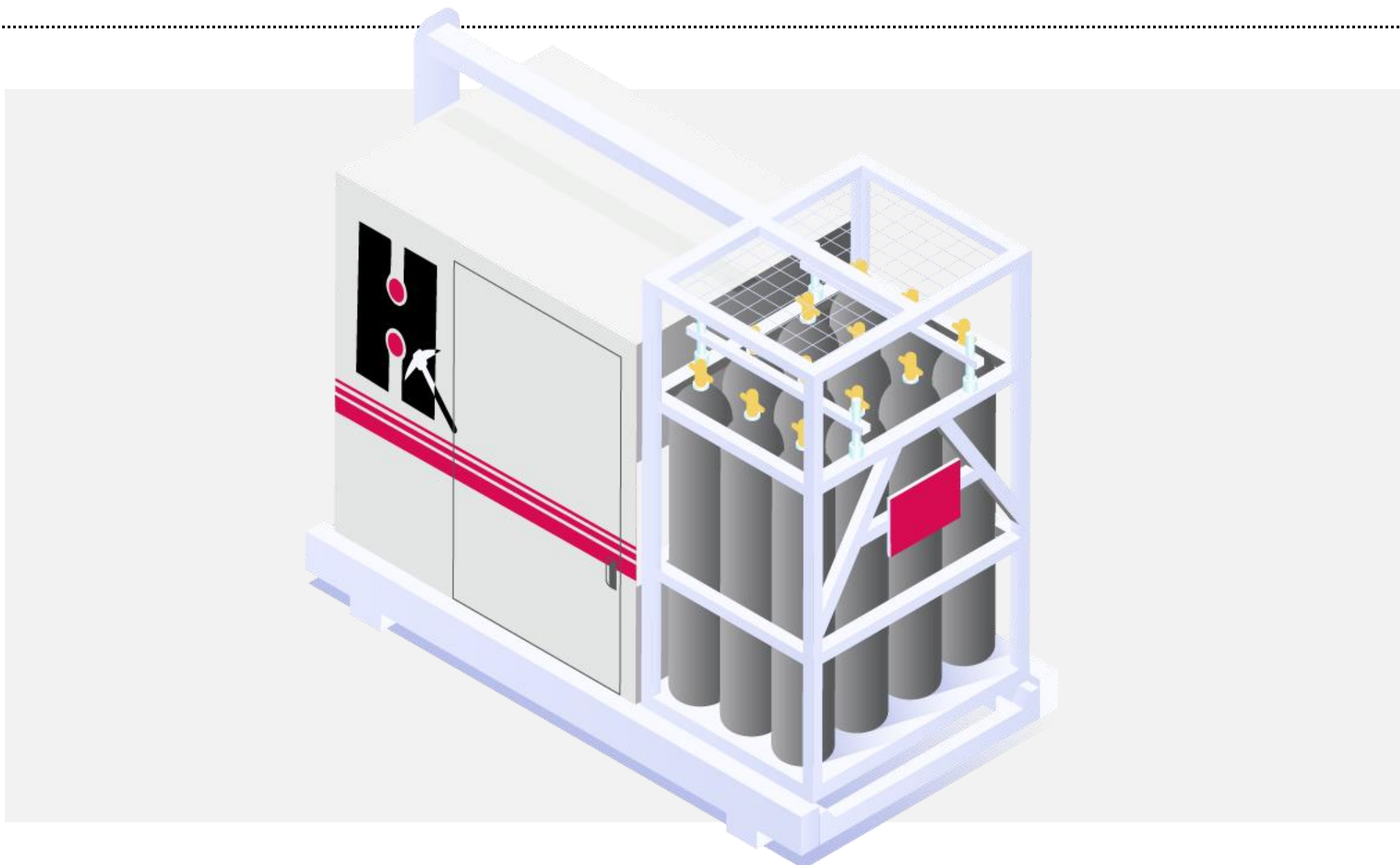




# Technology Demonstrators available for 2021 roadshow Nedstack Mobile GenSets and LAVO Hydrogen batteries

For our 2021 roadshow we propose to bring minimum viable product demonstrators. As relevant platforms we have selected the LAVO unit for office/hotel applications and the Nedstack PemGen MPU 20 for mobile power purposes.

# 2021

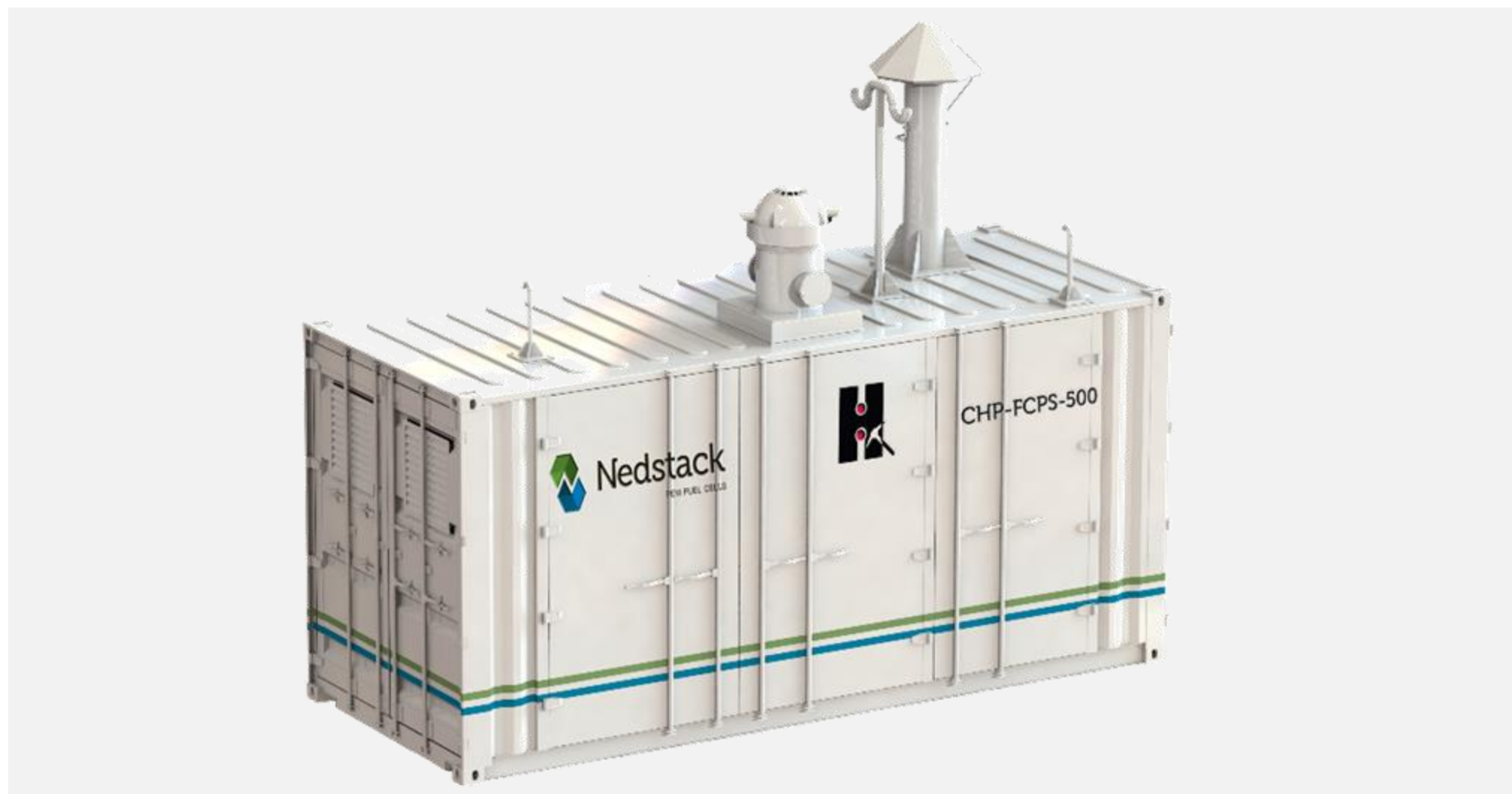


# Upscaled Solutions

## To be Planned by Intake

The team offers both utility scale PEM-Fuel cell Power Systems from the Nedstack PemGen Portfolio as well as large scale metal-hydride hydrogen storage from LAVO|HEOS (a LAVO group company). Such systems require 12-18 months delivery.

# 2022





# LAVO FUTURE PRODUCTS

With LAVO, the possibilities are endless

