

JOURNEY TO NET ZERO



Project Review & Lessons Learned

Why Hydrogen?

Sustainable benefits

- Net Zero targets
- Improvements in air quality

Flexible fuel for heat

- Domestic and industrial heat

• Transport applications

- Road, rail, air and sea
- Range anxiety, charging times
- Suits heavier /high-use applications

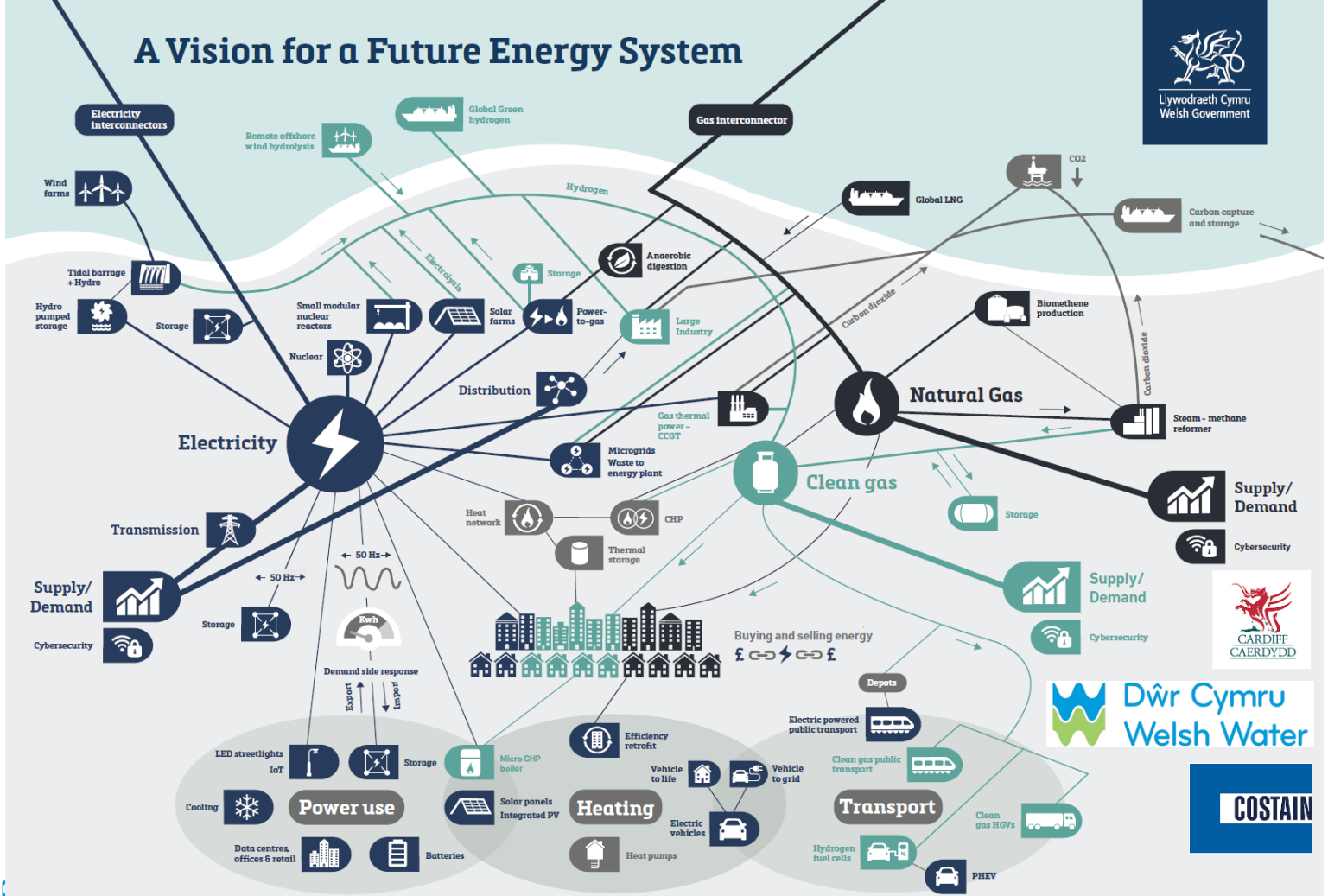


COSTAIN



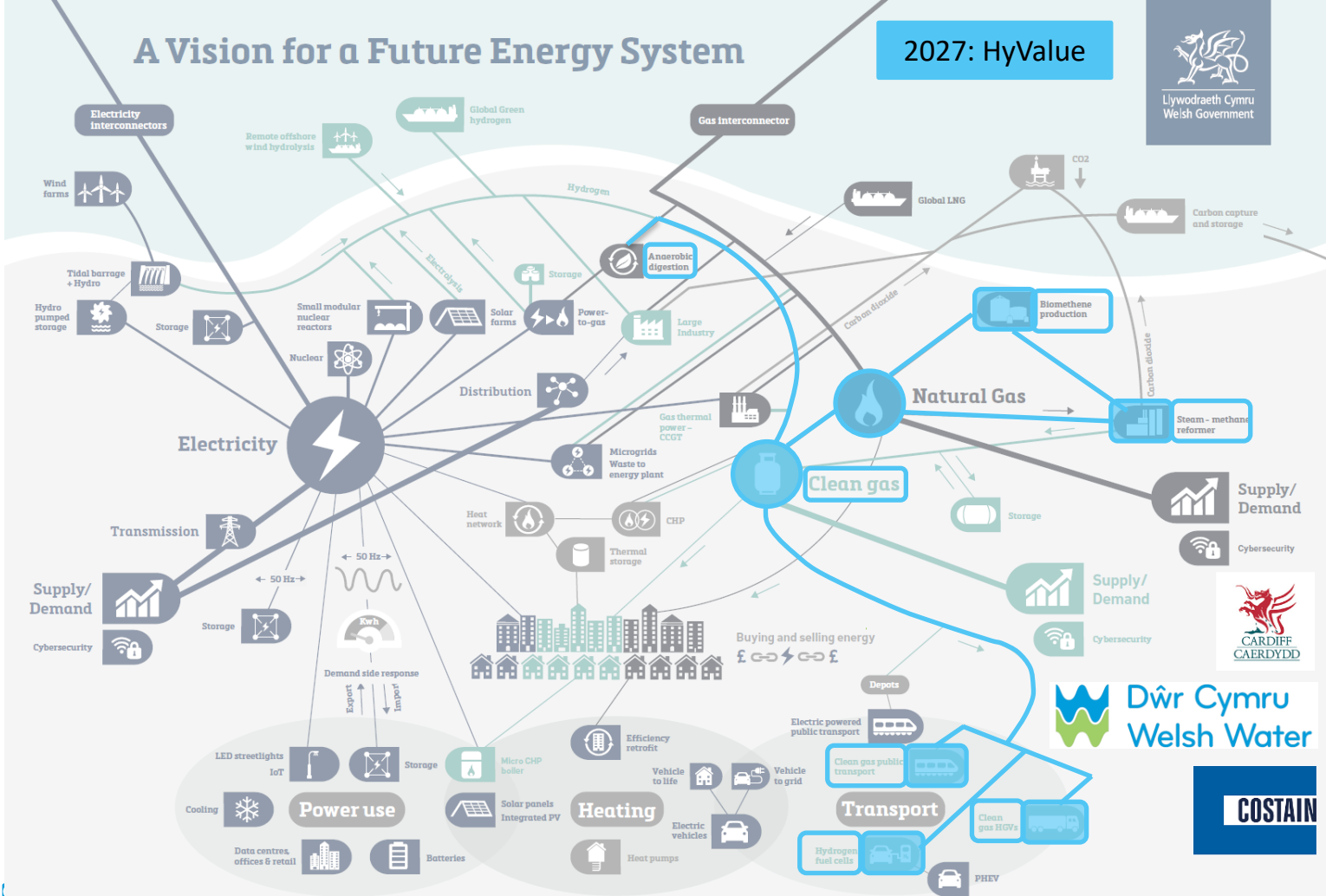
 Dŵr Cymru
Welsh Water

A Vision for a Future Energy System



A Vision for a Future Energy System

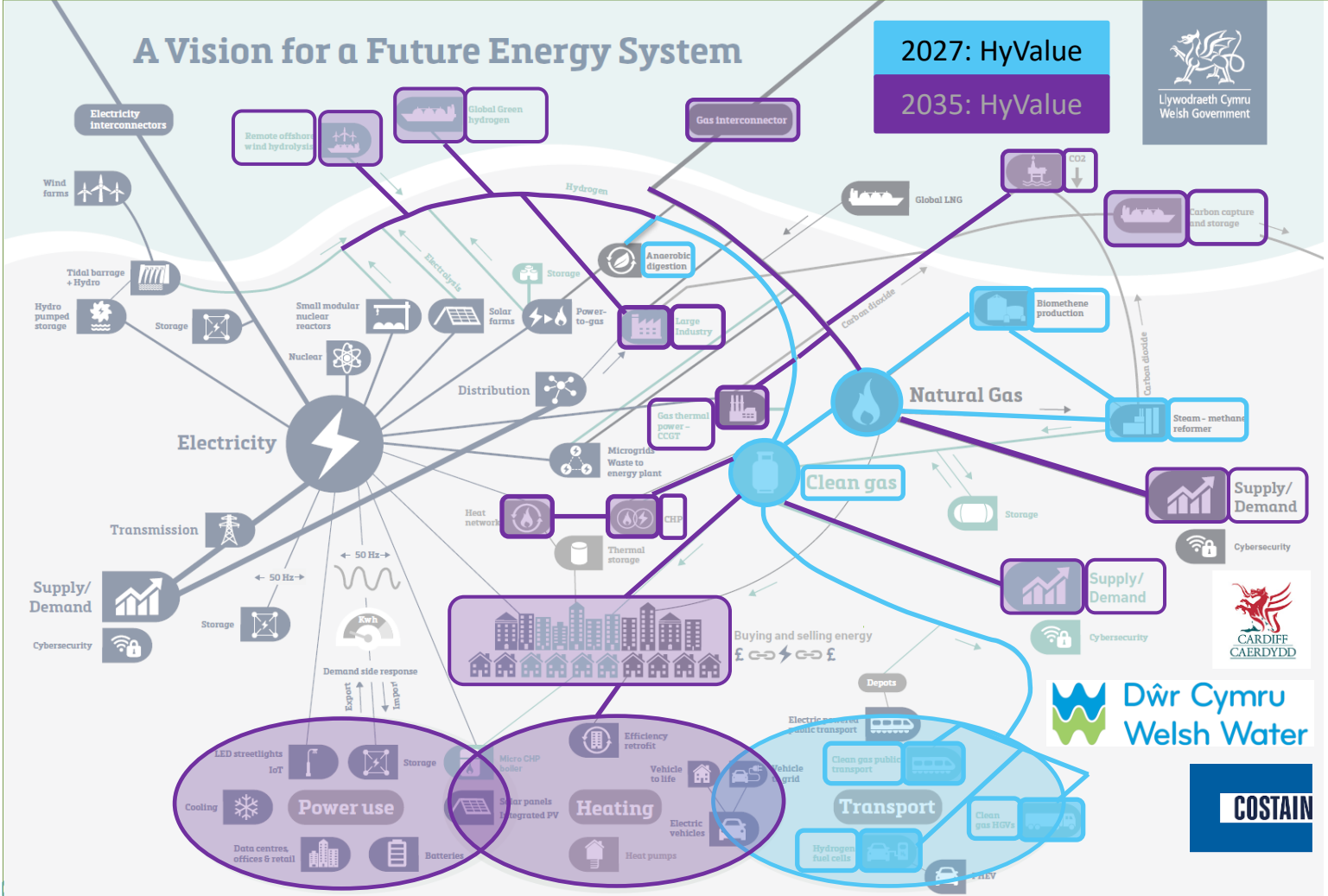
2027: HyValue



A Vision for a Future Energy System

2027: HyValue

2035: HyValue



HyValue : benefits



Dŵr Cymru
Welsh Water



9363
tCO₂/yr

Fuel Zero Emissions Vehicles

- Net zero CO₂
- Air quality improved

137
kg/yr
PM₁₀

Economic Benefits

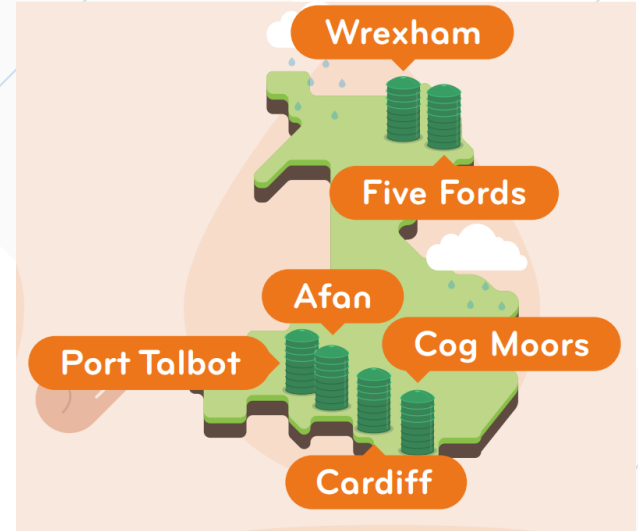
- Green jobs & attract new business

Wales as a Hydrogen Pioneer

- UK and globally

Roll-out for water sites


- Replicable Wales, then globally
- Link to South Wales industrial cluster




*Prelim Calc based on PM₁₀
Particulate matter (dust)*

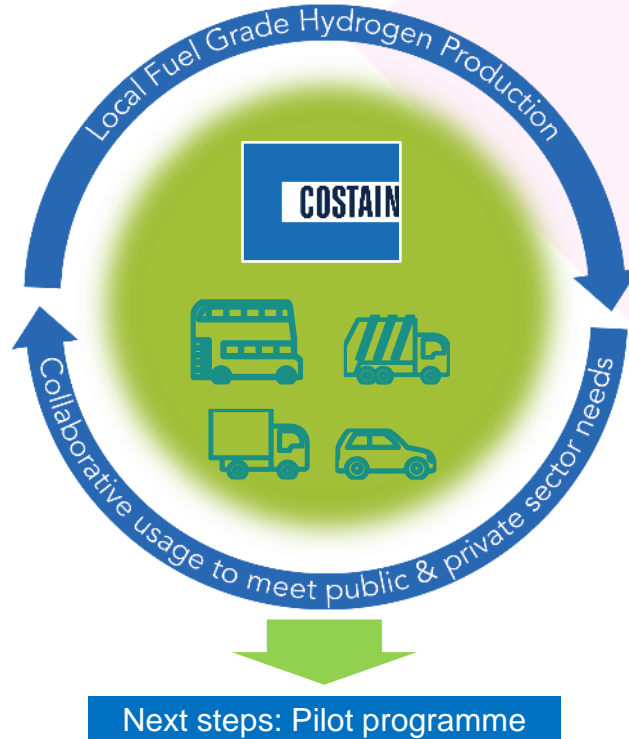
HyValue : sewage sludge to bio-hydrogen



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Welsh Water



Partnership with Costain to develop hydrogen production facility in Cardiff area
Converting existing waste biogas to deliver enough fuel grade H2 per day for local fleets



 Llywodraeth Cymru
Welsh Government

 CARDIFF
CAERDYDD



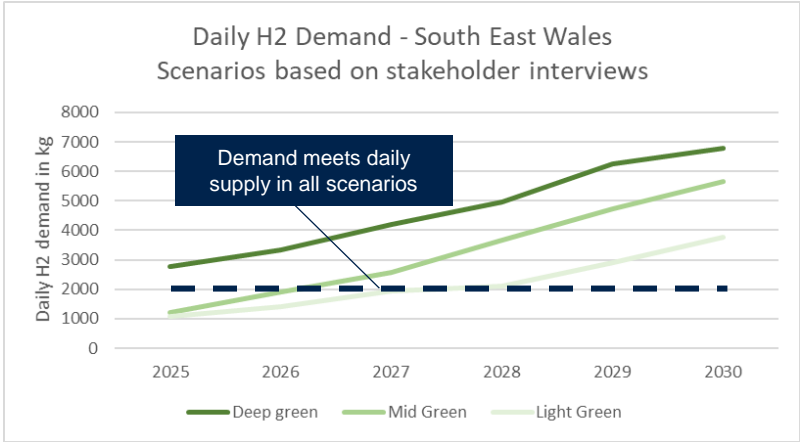
Partnership with Costain to understand potential hydrogen demand for transport in SE Wales

- Vehicle & fuel demand assessment
- Hydrogen production & distribution
- Total Cost of Ownership models
- Funding & procurement options

Demand assessment results

Potential volumes of fuel grade hydrogen mapped against 3 economic and technological viable scenarios showed the scheme was viable

Clear appetite for FCEV take-up but also clear steer that investment was key to kick-start the transition



Traws Cymru Cardiff centre to Cardiff Airport route



South Wales Police – Critical response vehicles



Local authorities within Cardiff Capital Region - Refuse Collection Vehicles



Cardiff Buses – certain routes

Project sponsors



Project supporters:



HyValue - findings

- HyValue 2000 kg/day of biohydrogen
 - fuel around 100 fuel cell buses
- Elements are well-understood
 - Biogas treatment - already at Five Fords
 - Converting biomethane to biohydrogen
 - Compression and storage
- Innovative mobile refuelling technology
 - NanoSUN Pioneer



Project sponsors



Project supporters:



HyValue - findings

- Scheme is technically and economically feasible
- Cardiff East appears suitable as a site
- Potential roll out across the UK, 20,000 tonnes/year hydrogen
- Strong stakeholder support
 - Local authorities, technology providers and fleet operators

Project sponsors



Project supporters:



Lessons learned - general

- Resilience when trying to innovate
- Engage key stakeholders and technology partner early
- Have an effective risk identification and management process

Risk & Opportunity Register		HyWau EXTENDED FEASIBILITY STUDY		Risk Legend		Risk Matrix	
3006-0110-0664-11-0001-001		Rev R2		3006-0110-0664-11-0001-001		Rev R2	
Risk Category	Risk or Opportunity	Risk / Opportunity	Effect	Impact	Severity	Probability	Updated for Extended Feasibility Study
1	C	Opportunity	Potential to use smaller standard packages as opposed to industrial design	Potential to reduce costs and lead time	2	-2	A
2	C	Risk	Risk of Brexit impacts compressor order from European supplier	Potential for import fees, delay or lack of available machine options	2	2	A
3	T	Risk	Risk that sufficient capacity is not available from existing site infrastructure. An water permit is not	Increased project cost for new systems	2	3	A
4	RO	Risk	Risk that existing foundations do not meet proposed new equipment foundations	Layout impact, reduction of equipment	2	2	A
5	R	Risk	Risk that vehicle package will become in excess of what is planned	Additional equipment required from LG. Possible difficult to source	3	3	A
6	T	Risk	Risk that unknown quantities in the biogas may pass through the system and damage fuel cell vehicles	Increased cost of fuel cell replacement	2	3	A
7	T	Risk	Risk that new materials used in alternative in the biogas may propagate through the system and damage the downstream reformer catalyst	Increased cost of DMF catalyst replacement	2	3	A
8	C	Risk	Risk that hydrogen is produced without monitoring without hydrogen sensors	Commercial viability decreases	2	3	A
9	C	Risk	Risk that COVID-19 impacts vehicle ramp procurement	Delay to Schedule	2	1	A
10	C	Risk	Risk that COVID-19 impacts vehicle ramp procurement	Delay to Schedule	2	1	A
11	C	Opportunity	Opportunity to increase carbon capture utilization storage (CCUS) from the carbon dioxide not stored from the steam methane reformer	Increased sustainability - process would be carbon negative	1	-3	A

Risk & opportunity matrix

Project sponsors



Project supporters:



Lessons learned - general

- Challenges of fitting on existing site for full-scale facility
- Consider existing facilities for physical trials



Project sponsors



Project supporters:



Lessons learned - general

- Cost inflation and business models
- Appetite for Net Zero projects
- Forthcoming guidance and regulation
- Consider permitting and consenting

Project sponsors



Project supporters:



Lessons learned – project-specific

- Fleet ownership models
- Small changes in composition could have a big impact
- Value of physical trials in reducing risks
- Adequate safety procedures and systems
- Opportunity for carbon negative with CCUS

Project sponsors

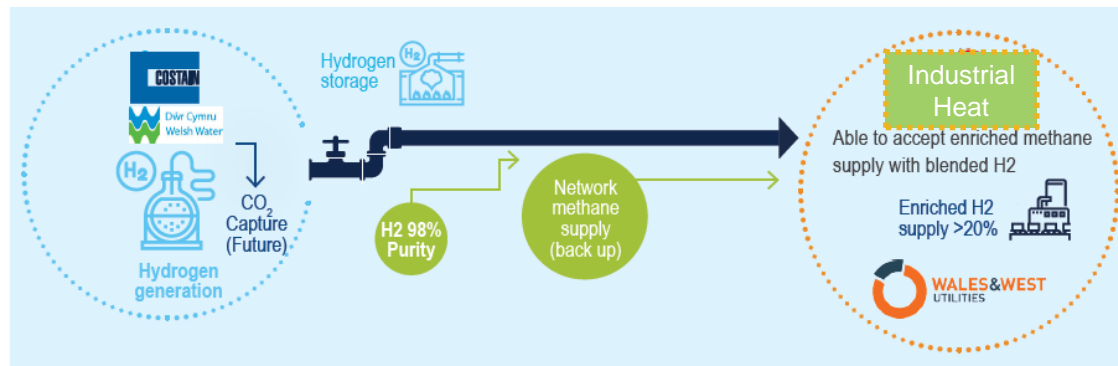


Project supporters:



Lessons learned – project-specific

- There may be additional opportunities
 - H2Juice project for DESNZ
 - Hydrogen piped to nearby heat users



JOURNEY TO NET ZERO



HyValue OfWAT project

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