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









HyValue : benefits

Dŵr Cymru Welsh Water



9363 tCO₂/yr 137 kg/yr PM₁₀

Fuel Zero Emissions Vehicles

- Net zero CO₂
- Air quality improved

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)









Supply & Demand



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







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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



Extended feasibility study - scope

- -Engineering deliverables
- -Levelised cost of hydrogen
- -Safety study
- -Layout & accessibility reviews

COSTAI C-162 BIOGAS 5-07-0001-001 Rev R2 cument Type: Report MRU WELSH WATER DOACTING TO ST ARY SAFETY STUDY DOMETING TO STEAM Welsh Wate on: Front End Solutions Document Owner: Lead Design HSE Engineer

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

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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 supporters:





Lessons learned - general

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

	Dir Cymru Welsh Water		Rink & Opportunity Register HyVwiwe EXTENDED FEASIBILITY STUDY 3000-0118-064.11.0001.001 Rev R2			His Gangery 1 - Socialized & Social 1 - Socialized & Social 1 - Socialized & Social 1 - Socialized & Social 2 - Conversid 1 - Socialized & Socialized 1 - Socialized & Socialized 1 - Socialized & Socialized 1 - Socialized & Socialized 2 - Socialized & Socialized 3 - Socialized										
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1	с	Opportunity	Potential to use vendor standard packages as opposed to individual design	 Potential to reduce costs and lead time. 	2	-2	340		2	4	-	Unitarged	2	4	-	
2	c	Rek	Risk of Brevit impacts compressor order from European suppliers	Potential for import tees, delay or lack of available machine options	2	3	1	Develop procurement plan in FEED Engage supply chain and determine Brevit risk	2	2	4	Some vendors have declined to bid, but generally most are open to UK work.	12	2.	2	
3	7	Rat.	Risk that sufficient capacity is not available from existing site infrastructure. Air, water, power, gas?	increased project cost for new systems	2	3		Perform surveys in FEED to confirm capacity available against expected requirements	4	3	3	Client discussions have indicated that during the project that sufficient capacity is available lased on latest vector information. Suffly summary. Client to advise on existing spare capacity on water, power 6, pas above estimated value. Instrument all will meed to be provided.	1	2		
4	PO	fisk .	Risk that existing foundations clash with proposed new equipment foundations.	Loyout impact, relocation of equipment	2	2	4	Engagement with site team, review of site documentation and early alle survey.	1	2	- 2	Unchanged	1	z	1.2	
5	Р.	Ruk .	Mink that vendor packages lead times increase at time of order placement.	Cellay to schedule. Potential impact of Bayolach equipment sourced from US proving difficult to import	3	3		Early definition of lead times. Usual regular communication with suppliers during procurement.	3	2		Vendors were re-angaged during this phase, prices Δ lead times fed into planning.	2	2.		
4	7	Plan	Risk that unknown impurities in the biogos may propagate through the system and damage fuel cell vehicle catalyst	Increased cost of fuel cell replacement	2	3		Further sampling of the biogas over an extended period of time. Testing will also be carried out during the trial period.	9	2		Trial achieve and vendors re-engaged during this phase.	1	3		
a.	т	Rak.	Risk that trace elements (such as slowanes) in the biogas may procedure through the system and damage the steam methans reformer cataliget.	Increased cost of SMR catalyst replacement	2	3		Further sampling of the likeps over an extended period of time. Yeeking will also be samed out during the time period. Technology review will assess the role of take somponent and how they can be treated to meet the severthering review.	ä	×.		Biogan Upgrade vendors have indicated that SMR Feed Spec is adviewable. Any other impurties should be able to be removed using activities carbon filters or another unit operation.	a.	2		
•	c	na.	Risk that hydrogen is produced without establishing sufficient hydrogen users	Commercial visibility decreases	2	3		Ensure off-take contracts are in place prior to the detailed design.	4	3	•	Folential to use hydrogen for other industrial purposes should avert impact of insufficient hydrogen users. Week Water to begin insuetoption from Q1 2023	я.	2	2	
10	c	Rek	Risk that COVID-19 impacts vendors during procurement	Delay to Schedule	2	۲		Develop procurement plan in PEED Engage supply chain and determine COVID-19			1.00	Plaik posed by COVID-15 has subsided but miligations are effl unchanged.	1			
11	e.	Opportunity	Opportunity to involve more statisticiders interested in trialling hydrogen production from brogge	Potential to reduce costs during Phase 2 SBRI Trial	2	-2	- 41					Unchanged	2	4	4	
12		Opportunity	Opportunity to incorporate carbon capture utilisation storage (OCUS) from the carbon discide rich atware from the ateam	increased sustainability - process		-3	-2					CAPEX & OPEX has been investigated in COUS Study.		a	- 14	

Risk & opportunity matrix

Project supporters:





Lessons learned - general

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







Project supporters:







Lessons learned - general

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

Project supporters:





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



Lessons learned – project-specific

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



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Project supporters:



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