UK-HyRES:
UKRI Co-ordinator for Research Challenges in Hydrogen and Alternative Liquid Carriers

Tim Mays
University of Bath

Hydrogen and Fuel Cell Research Conference
University of St Andrews, 8-9 June 2022

SUMMARY

This presentation will outline the context and project details of the

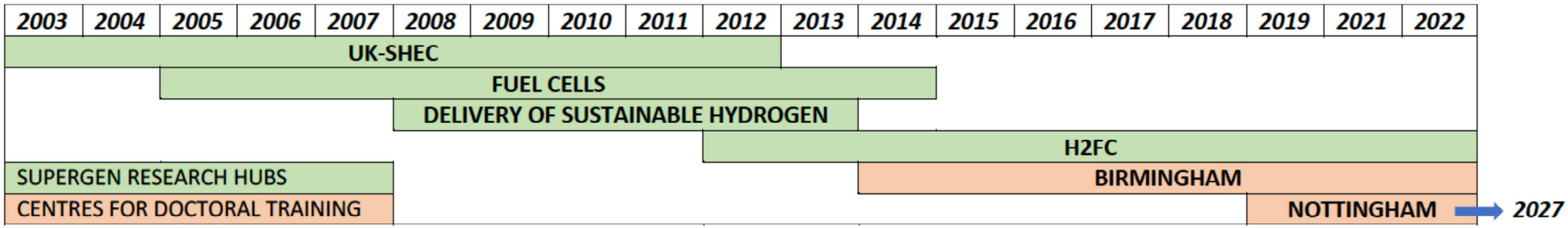
UKRI Co-ordinator for Research Challenges in Hydrogen and Alternative Liquid Fuels

the aim of which is to build a

UK Centre of Research Excellence in Hydrogen and Alternative Liquid Fuels

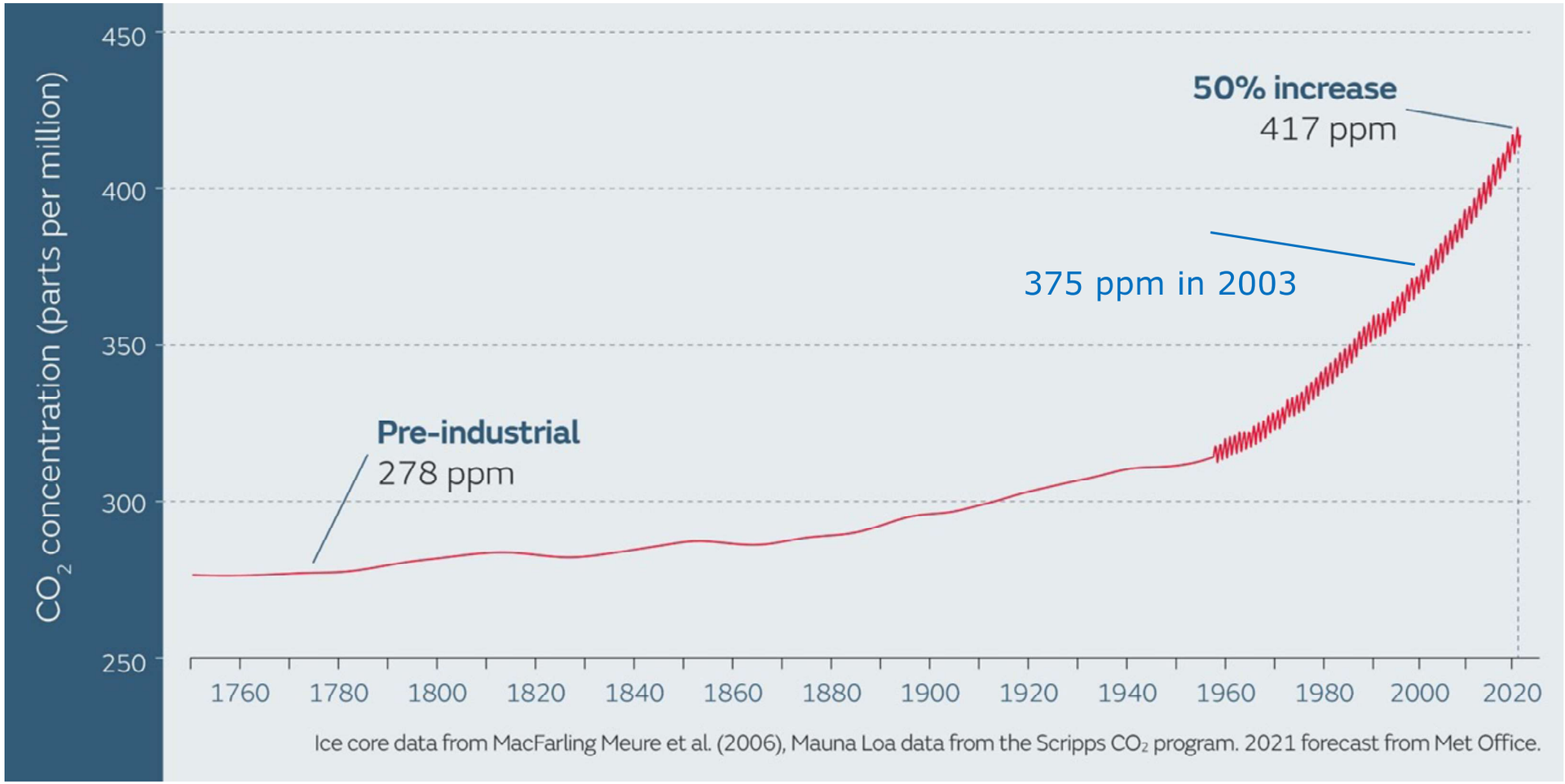
UK-HyRES

NEARLY 20 YEARS OF EPSRC RESEARCH AND TRAINING INVESTMENTS IN HYDROGEN AND FUEL CELLS



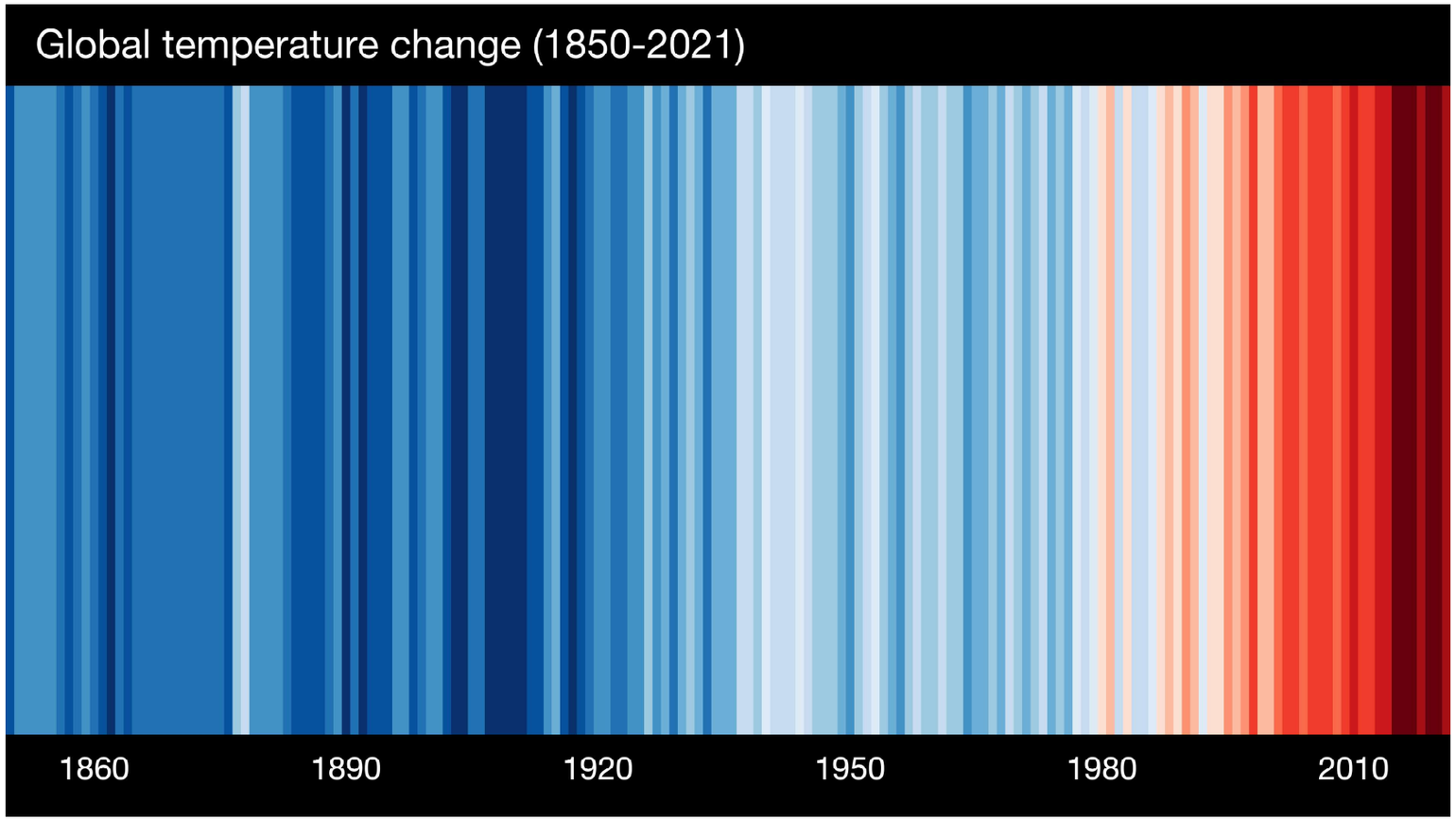
EPSRC
Engineering and Physical Sciences Research Council

ATMOSPHERIC CO_2 – 420 ppm NOW



Source: Met Office

CLIMATE STRIPES



Source: University of Reading

CLIMATE CHANGE

Source: Stanford University

UK POLICY

STATUTORY INSTRUMENTS

2019 No. 1056

CLIMATE CHANGE

The Climate Change Act 2008 (2050 Target Amendment) Order 2019

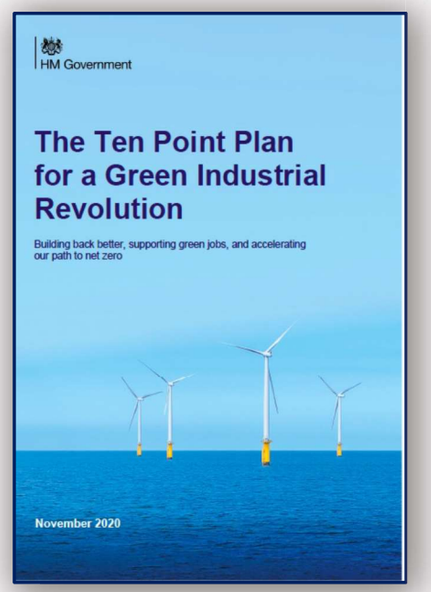
Citation and commencement

1. This Order may be cited as the Climate Change Act 2008 (2050 Target Amendment) Order 2019 and comes into force on the day after the day on which it is made.

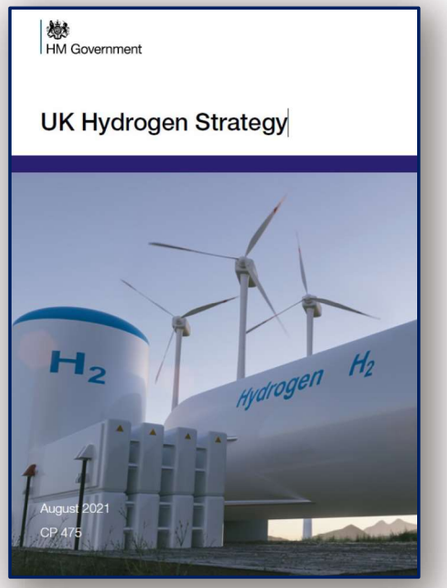
Amendment of the target for 2050

2.—(1) Section 1 of the Climate Change Act 2008 is amended as follows.

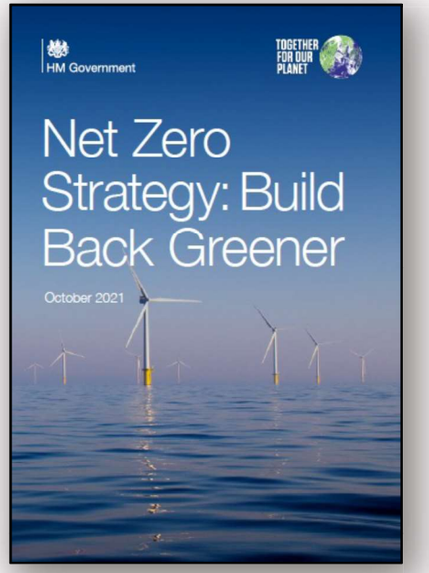
(2) In subsection (1), for "80%" substitute "100%".



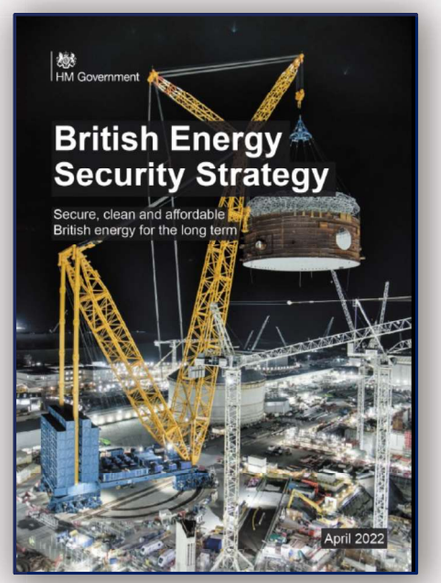
November 2020



April 2021



October 2021



April 2022

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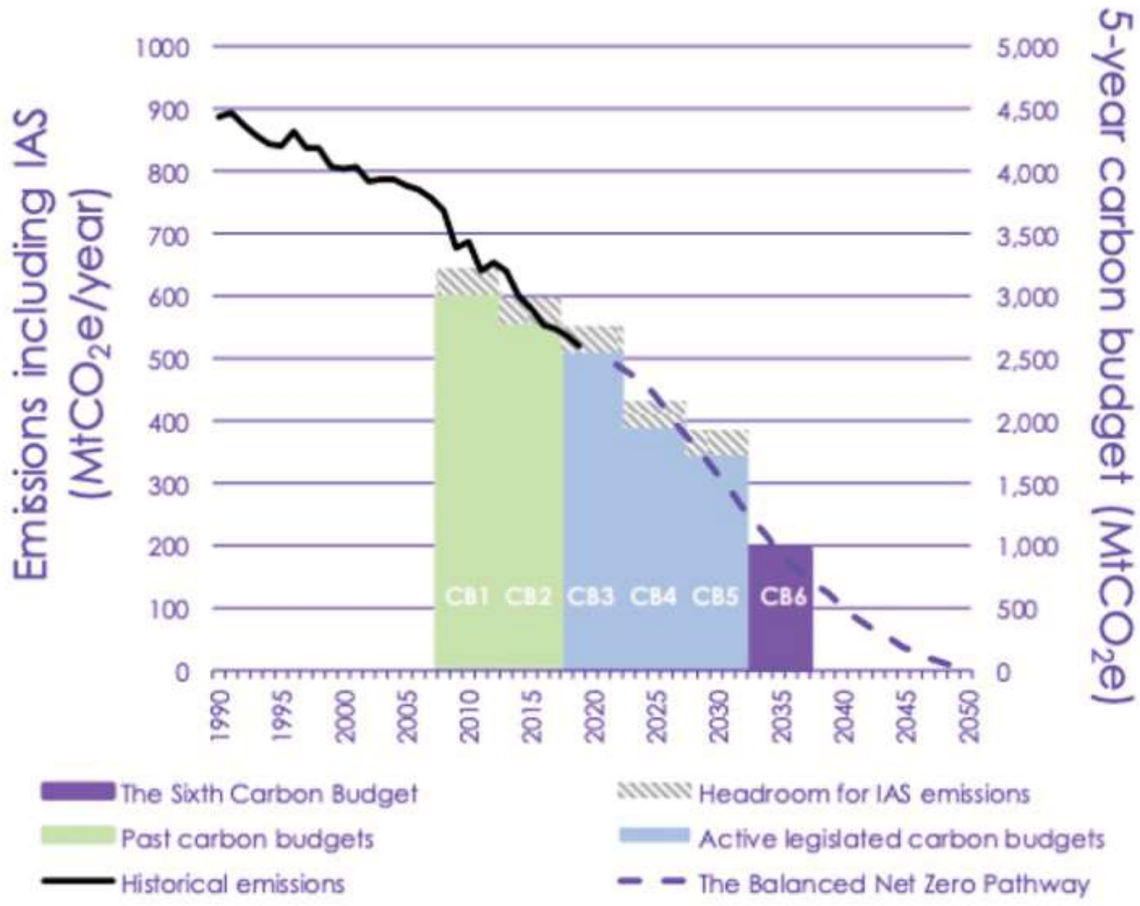
UK CARBON BUDGETS



Source: Climate Change Committee

HYDROGEN AND THE TEN POINT PLAN

Point 1
Advancing Offshore Wind

Point 2
Driving the Growth of Low Carbon Hydrogen

Point 3
Delivering New and Advanced Nuclear Power

Point 4
Accelerating the Shift to Zero Emission Vehicles

Point 5
Green Public Transport, Cycling and Walking

Point 6
Jet Zero and Green Ships

Point 7
Greener Buildings

Point 8
Investing in Carbon Capture, Usage and Storage

Point 9
Protecting Our Natural Environment

Point 10
Green Finance and Innovation

Source: UK Government (not the ✓ nor ▭)

UKRI CALL

UK Research and Innovation

Funding opportunity

Become a hydrogen research coordinator

Opportunity status:	Closed
Funders:	Engineering and Physical Sciences Research Council (EPSRC)
Funding type:	Grant
Total fund:	£700,000
Maximum award:	£350,000
Publication date:	2 September 2021
Opening date:	7 September 2021 09:00 UK time
Closing date:	30 November 2021 16:00 UK time

Last updated: 26 January 2022

Apply for funding to become a hydrogen research coordinator.

Timeline

- **7 September 2021 09:00** Opening date
- **30 November 2021 16:00** Closing date
- **January 2022** Sift panel
- **W/c 31 January and w/c 7 February 2022** Interview panels
- **1 April 2022** Grant fixed date start

Call:
https://www.ukri.org/opportunity/become-a-hydrogen-research-coordinator/

Grant award details:
https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=**EP/W035529/1**

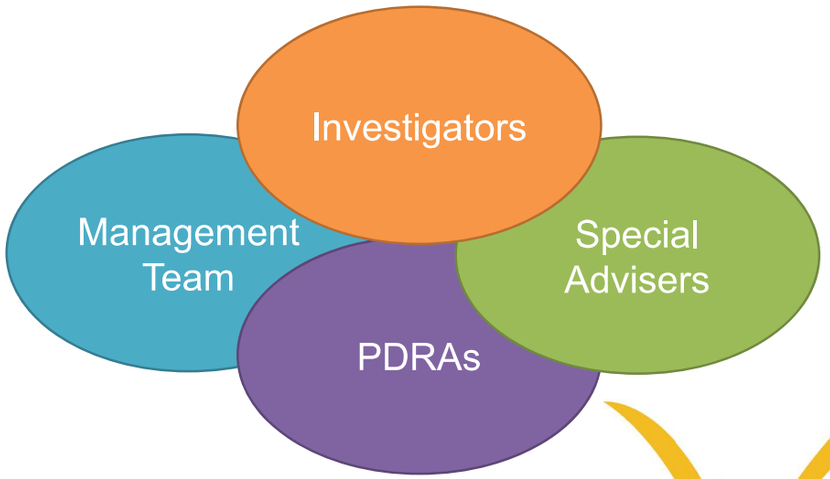
six months → **30 September 2022**

UK Research and Innovation

Co-Ordinator for Research Challenges in Hydrogen & Alternative Liquid Fuels

UK-HyRES

VISION An **inclusive**, **inter-disciplinary** community to **co-create** a plan to tackle the research challenges in hydrogen & alternative liquid fuels for Net Zero. This will lay the foundation of a **UK Centre of Research Excellence in Hydrogen & Alternative Liquid Fuels: UK-HyRES**



Identification & prioritisation of research challenges

A uniquely connected & informed H&ALF research community

UK-HyRES White Paper

Theory of Change Implemented through accessible, facilitated workshops with direction from special advisers

Why?	What?	How?	How?	What?	Why?
Strategic Drivers	Challenges & Barriers	Opportunities for Research	Outputs	Change (Outcomes)	Impact (Difference & Added Value)

TWO LINKED CO-ORDINATOR PROJECTS

Research challenges in hydrogen and alternative liquid fuels

The coordinator for this area should look to create a consortium and research plan which will tackle research challenges that underpin the hydrogen production, storage and distribution parts of the hydrogen value chain. They may also seek to address issues that will impact upon the hydrogen end-use sectors. These may include, but are not limited to, challenges associated with:

- lowering costs of hydrogen technologies
- increasing efficiencies of technological systems
- materials science and engineering
- hydrogen safety.

Systems integration of hydrogen and alternative liquid fuels

Integration can be taken to mean integration within whole energy systems that can include:

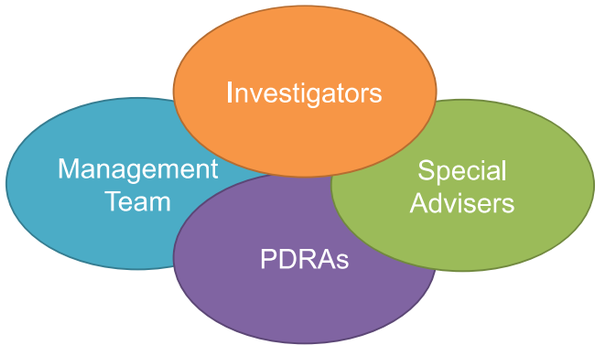
- international settings
- whole systems integration across technologies
- technology coupling requirements
- trade-off analysis across technology options
- whole systems.

UK-HyRES

- Low TRL research mainly in the EPS space and with identified and significant impacts leading to Net Zero
- Inter-disciplinary and cross-cutting research
- Completely agnostic about technologies
- Strong, national stakeholder engagement
- Equality, diversity and inclusion
- Responsible innovation and ethics
- Building sustainable capacity and talent pipelines

Grant award details:
https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=**EP/W035502/1**

PI: Prof Sara Walker
Newcastle University



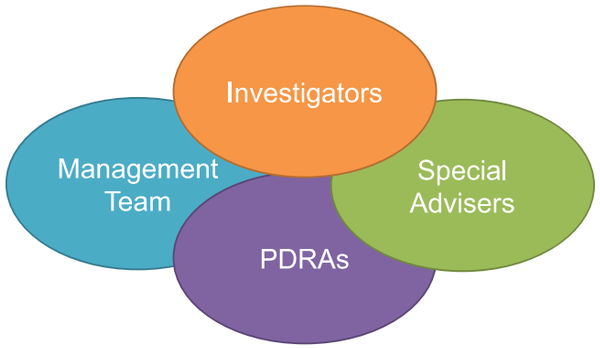
UK-HyRES

INVESTIGATOR TEAM

Principal Investigator
Prof Tim Mays
University of Bath

Co-Investigator
Prof Rachael Rothman
University of Sheffield

Co-Investigator
Prof Shanwen Tao
University of Warwick



MANAGEMENT TEAM

Project Manager
Dr Yankı Keleş
University of Bath

Project Support
Taiga Nishimura
University of Bath

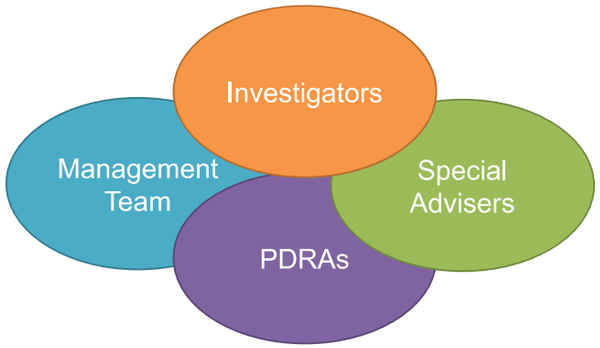
Project Support
Carla Teale
University of Sheffield

Project Support
Matt Phillips
University of Warwick

Facilitation and Visualisation

THE COLLECTIVE

Scriberia

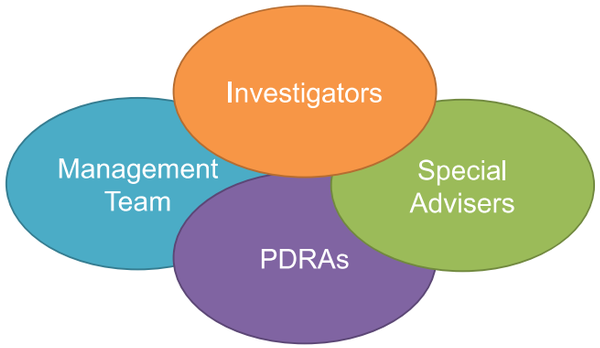


RESEARCHER TEAM

Research Support
Rajan Jagpal
University of Bath

Research Support
Dr Diarmid Roberts
University of Sheffield

Research Support
Dr Mengfei Zhang
University of Warwick



UK-HyRES

SPECIAL ADVISOR TEAM

GKN AEROSPACE

HSE Health & Safety Executive

JAGUAR

LAND ROVER

ITM POWER
Energy Storage | Clean Fuel

SCOTTISH Hydrogen & Fuel Cell ASSOCIATION

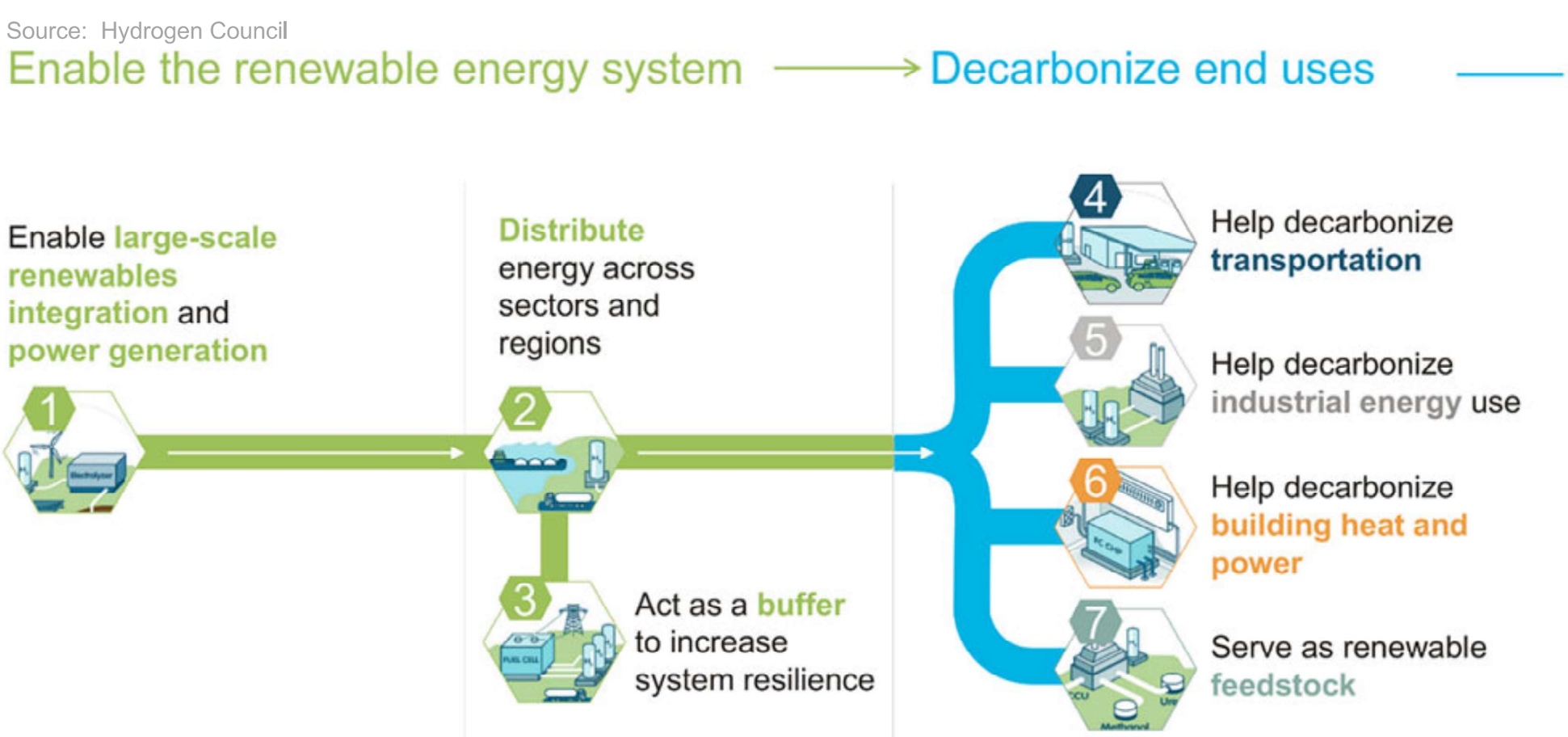
SIEMENS energy

WALES&WEST UTILITIES

2022 WORKSHOPS: THEMES

Production, Storage / Distribution, End Use, Alternative Carriers

Source: Hydrogen Council



2022 WORKSHOPS: DATES

Production, Storage / Distribution, End Use, Alternative Carriers

ONLINE PROJECT LAUNCH
13:30 – 16:30 Monday 6 May

ONLINE WORKSHOP 1 – Hydrogen production
09:30 – 12:30 Thursday 16 June

ONLINE WORKSHOP 2 – Hydrogen storage / distribution
13:30 –16:30 Thursday 16 June

ONLINE WORKSHOP 3 – Hydrogen end use
09:30-12:30 Tuesday 5 July

ONLINE WORKSHOP 4 – Alternative carriers
13:30 –16:30 Wednesday 20 July

IN PERSON RESEARCH CHALLENGES SHOWCASE
Thursday 15 September
University of Warwick

Please see ….

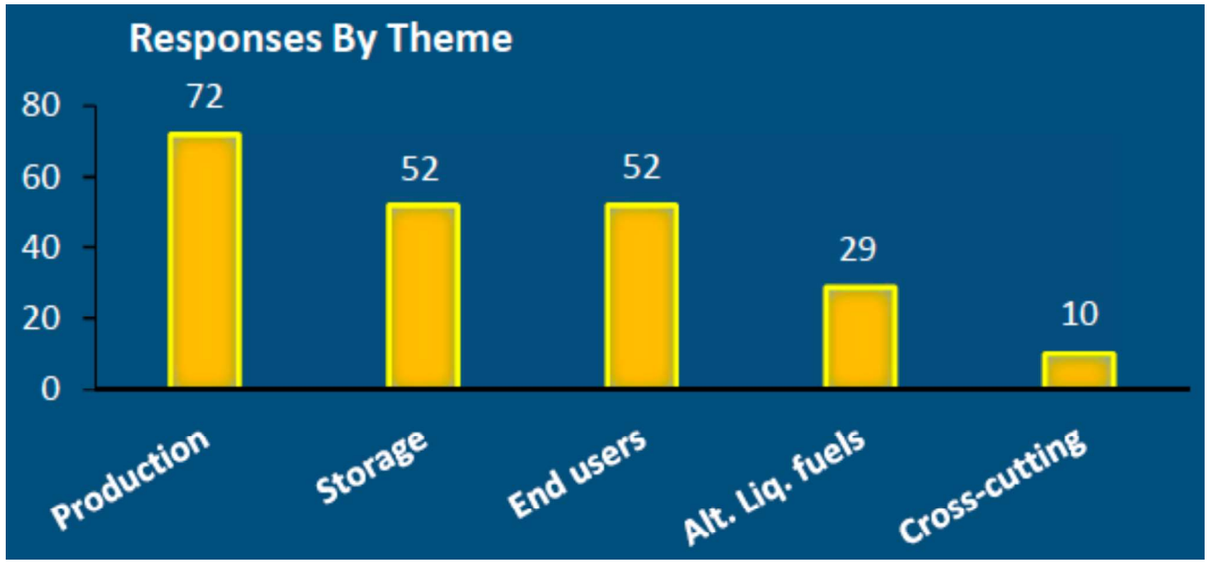
https://ukhyres.co.uk

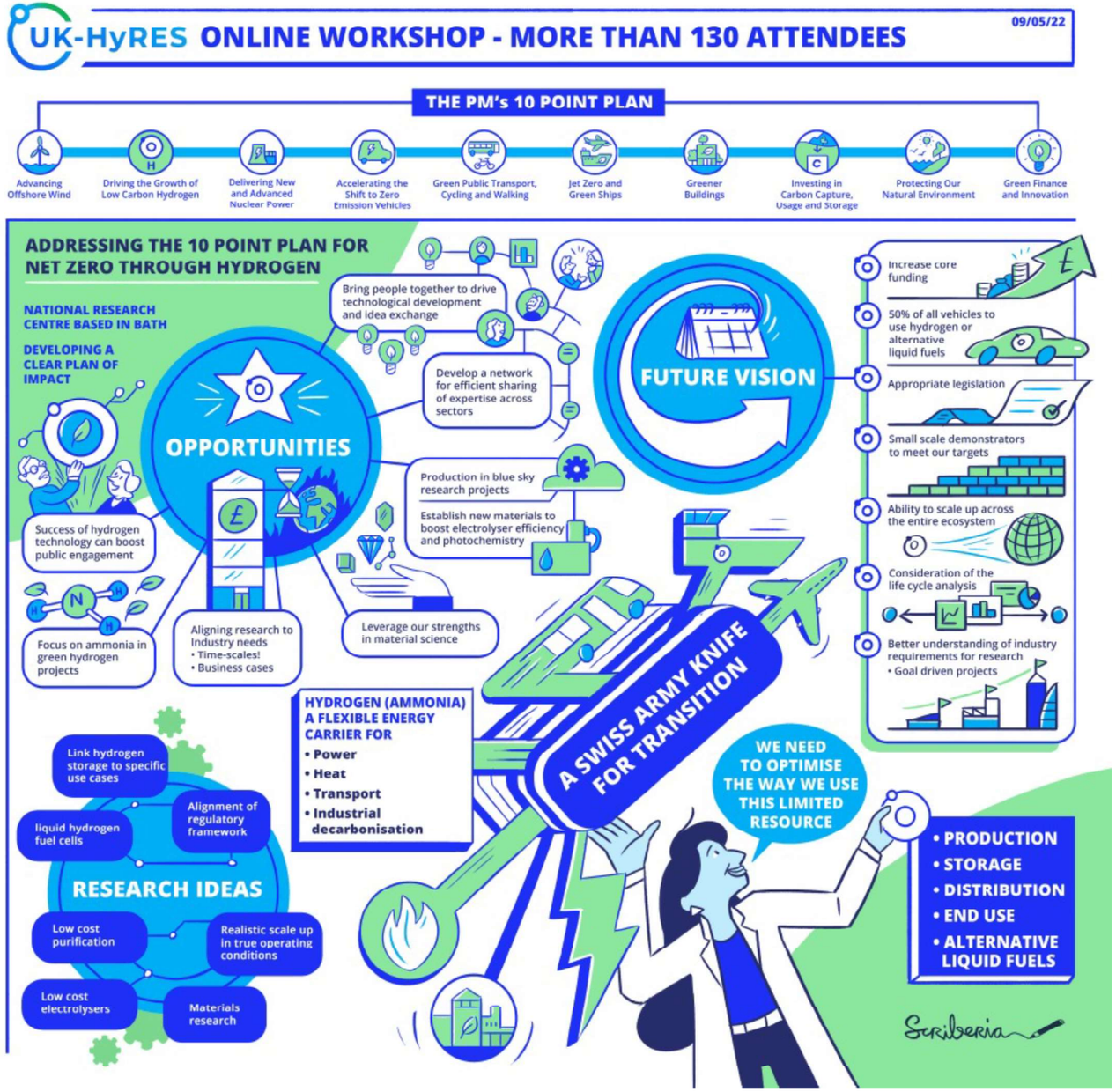
@UkHyres

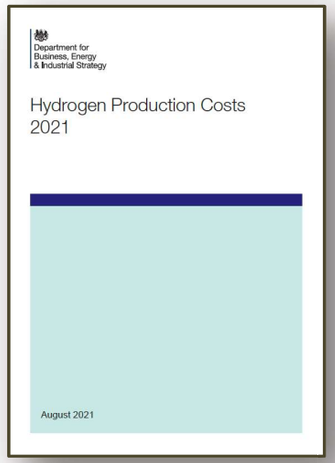
2022 PROJECT LAUNCH

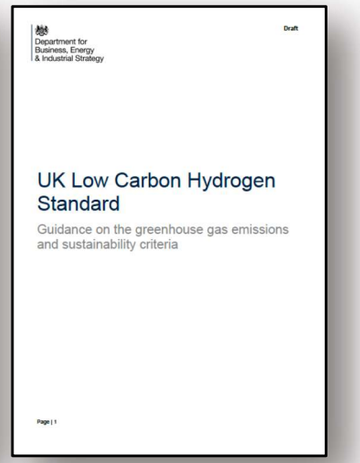
Online 13:30 – 16:30 Monday 6 May

UK-HyRES Board Meeting
Bath Royal Literary and Scientific Institution




UK-HyRES ONLINE WORKSHOP - MORE THAN 130 ATTENDEES
09/05/22
THE PM's 10 POINT PLAN
Advancing Offshore Wind
Driving the Growth of Low Carbon Hydrogen
Delivering New and Advanced Nuclear Power
Accelerating the Shift to Zero Emission Vehicles
Green Public Transport, Cycling and Walking
Jet Zero and Green Ships
Greener Buildings
Investing in Carbon Capture, Usage and Storage
Protecting Our Natural Environment
Green Finance and Innovation
ADDRESSING THE 10 POINT PLAN FOR NET ZERO THROUGH HYDROGEN
NATIONAL RESEARCH CENTRE BASED IN BATH
DEVELOPING A CLEAR PLAN OF IMPACT
OPPORTUNITIES
Bring people together to drive technological development and idea exchange
Develop a network for efficient sharing of expertise across sectors
Production in blue sky research projects
Establish new materials to boost electrolyser efficiency and photochemistry
Leverage our strengths in material science
Aligning research to Industry needs
• Time-scales!
• Business cases
Success of hydrogen technology can boost public engagement
Focus on ammonia in green hydrogen projects
FUTURE VISION
Increase core funding
50% of all vehicles to use hydrogen or alternative liquid fuels
Appropriate legislation
Small scale demonstrators to meet our targets
Ability to scale up across the entire ecosystem
Consideration of the life cycle analysis
Better understanding of industry requirements for research
• Goal driven projects
A SWISS ARMY KNIFE FOR TRANSITION
HYDROGEN (AMMONIA) A FLEXIBLE ENERGY CARRIER FOR
• Power
• Heat
• Transport
• Industrial decarbonisation
RESEARCH IDEAS
Link hydrogen storage to specific use cases
Alignment of regulatory framework
liquid hydrogen fuel cells
Low cost purification
Realistic scale up in true operating conditions
Low cost electrolysers
Materials research
WE NEED TO OPTIMISE THE WAY WE USE THIS LIMITED RESOURCE
• PRODUCTION
• STORAGE
• DISTRIBUTION
• END USE
• ALTERNATIVE LIQUID FUELS
Scriberia





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2022 WORKSHOP 1

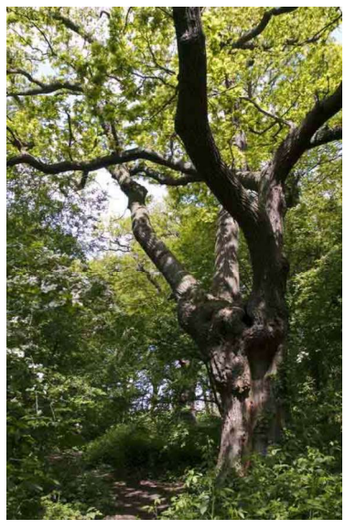
Hydrogen production

Online 09:30 – 12:30 Thursday 16 June

Identify leading research challenges for hydrogen production, including up to 10 GW by 2030.

water
(H_2O)

~10^{18} m^3



biomass
($-CH_xO_y$)

~10^{15} kg (dry)

fossil
fuels
($-CH_z$)

2022 WORKSHOP 2

Hydrogen storage / distribution

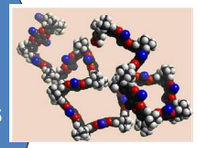
Online 13:30 – 16:30 Thursday 16 June

Identify leading research challenges to store and distribute hydrogen.

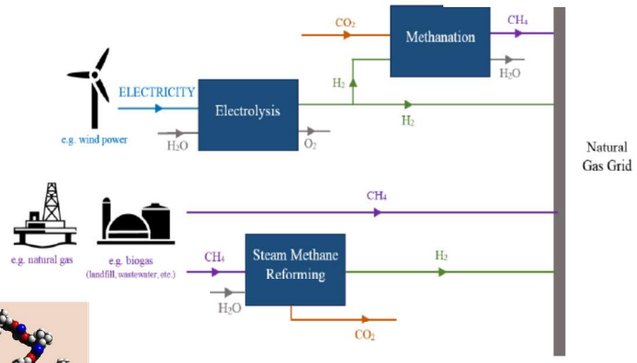
Physical

molecular or di-hydrogen, H_2

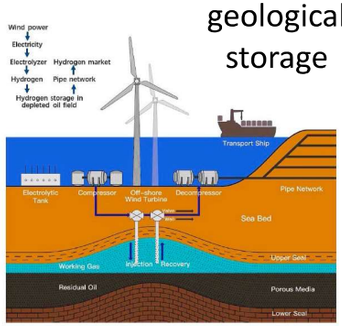
Liquid and / or solid
Compressed gas
Containment in porous solids



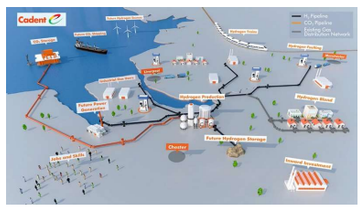
blending



geological storage

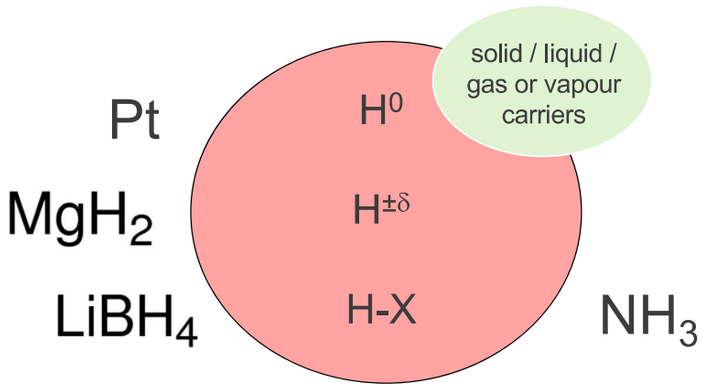


pipelines



Chemical

atomic, ionic, covalent hydrogen

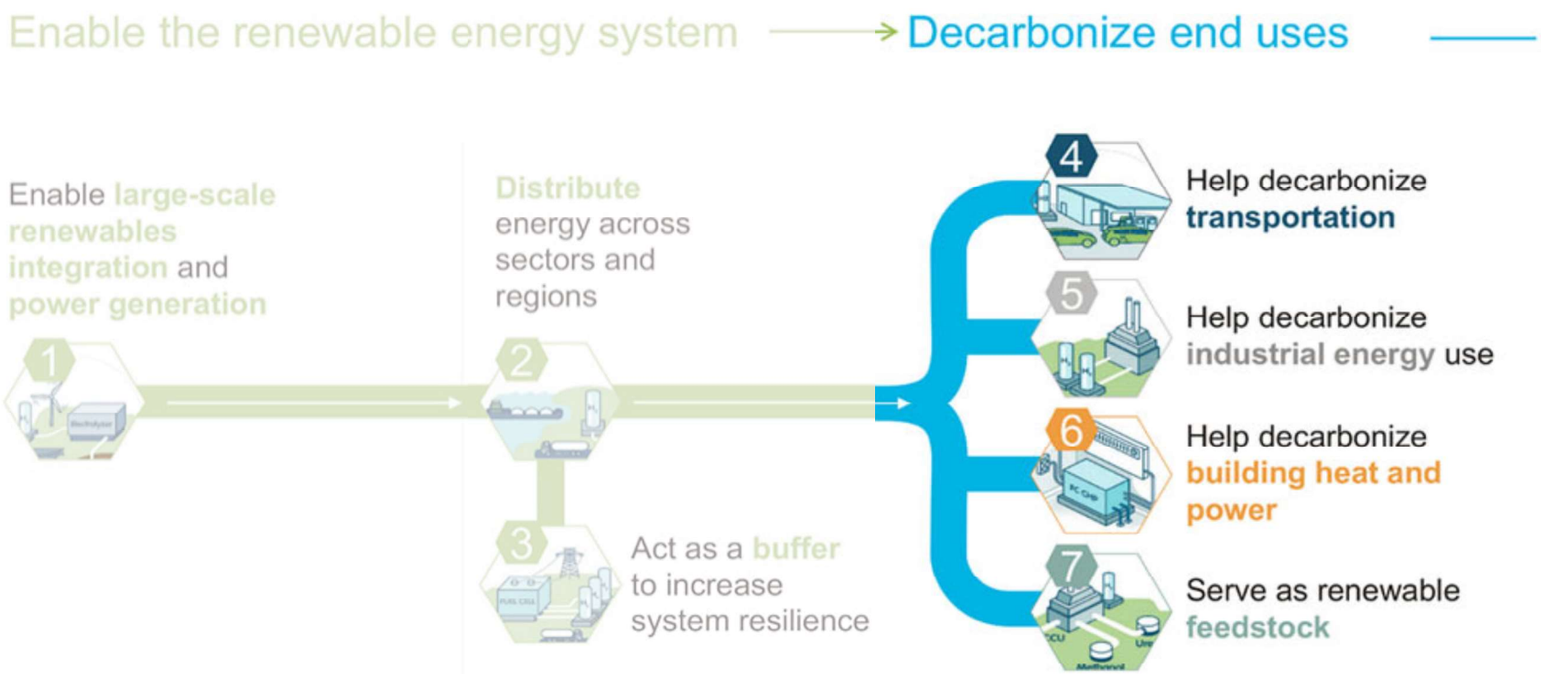


2022 WORKSHOP 3

Hydrogen end use

Online 13:30 – 16:30 Tuesday 5 July

Identify leading research challenges for hydrogen end use (combustion, fuel cells, industrial gas).



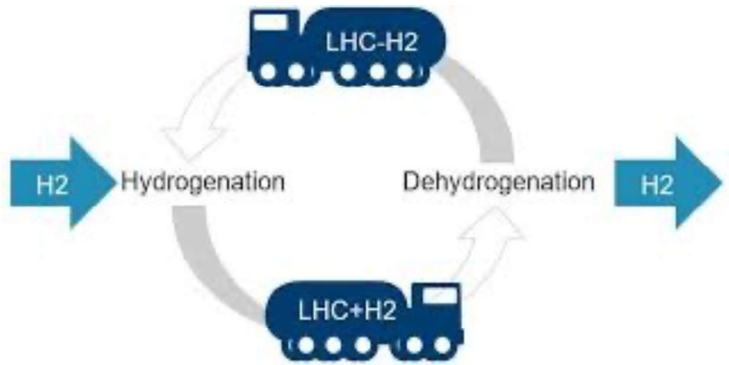
2022 WORKSHOP 4

Alternative carriers

Online 13:30 – 16:30 Wednesday 20 July

Identify leading research challenges for alternative liquid hydrogen carriers.

ammonia



formic acid, alcohols, hydrous hydrazine, primary amines, liquid organic hydrogen carriers, sustainable aviation fuels, …

2022 RESEARCH SHOWCASE – More anon

In Person Thursday 15 September
University of Warwick

Reflecting on project outcomes and looking forward to the national Centre.

NEXT STEPS

- Online Workshops 1-4 and Showcase
- Strong engagement with Systems Co-Ordinator
- EPSRC *Engineering Net Zero*, Glasgow, June 2022
- Bridging, October 2022 – March 2023 (?)
- Centre details (budget, start date, duration, …)

https://ukhyres.co.uk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