Net Zero

21st September 2022

Net Zero Hub
Sally Lloyd Davies
Catherine Spriggs
Kate Jeffrey

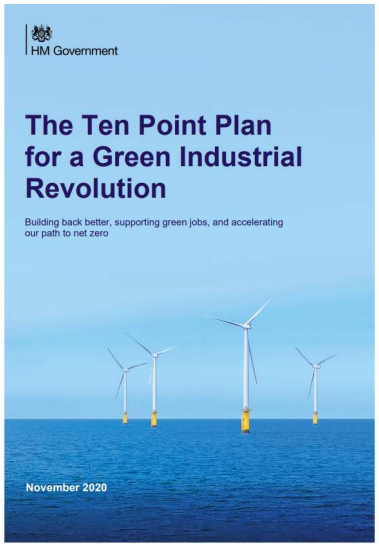
Welcome

11:00 – 12.30 How HSE is approaching Net Zero

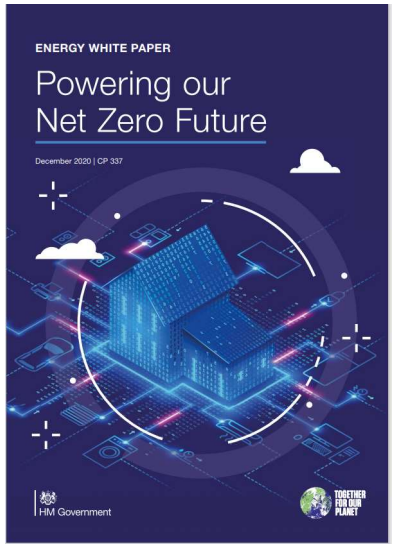
- UK Net Zero Context
- HSE Net Zero Hub
- Net Zero Technology Areas
- Hydrogen Heating Programme
- Hydrogen Research

UK Net Zero Context

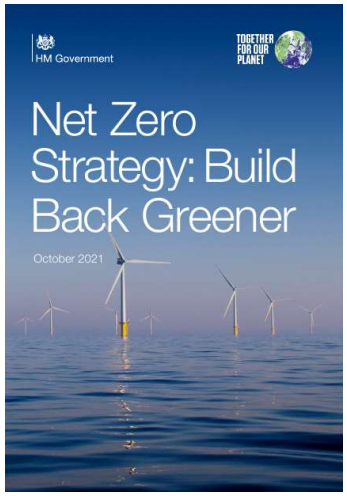
UK Net Zero Context



18th November 2020



14th December 2020



19th October 2021

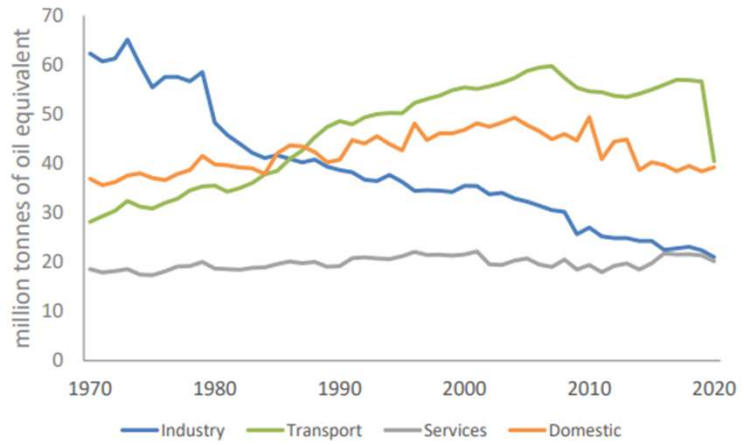
What is Net Zero?

Net Zero refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach Net Zero when the amount we add is no more than the amount taken away. Getting to that point will mean a significant change to how energy is produced (energy transition) and also how we adapt to the effects of climate change.

Net Zero is broad in scope and impacts on work across HSE: through science and research into the health and safety impacts of new technology e.g. use of hydrogen for heating and energy; through policy teams ensuring the regulatory framework remains fit for purpose when applied to new technologies; and through regulatory teams engaging with dutyholders as they adapt their processes and move into new technology areas. Underpinning the transition to Net Zero is the need to build and maintain public confidence in the safety of the new technologies.

UK Energy Context

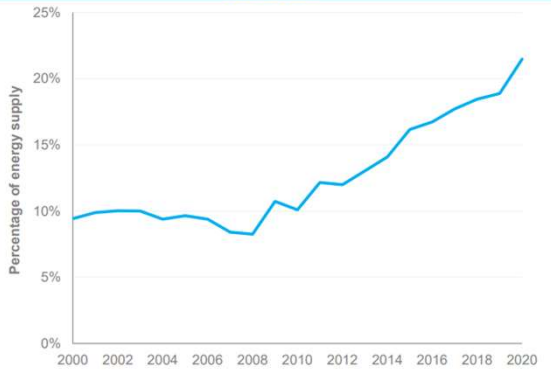
Change in energy consumption by sector



Energy Consumption in the UK (ECUK) 1970 to 2020 [Energy consumption in the UK 2021 - GOV.UK (www.gov.uk)]

OVERALL ENERGY

Proportion of UK energy supplied from low carbon sources, 2000 to 2020



Percentage

	2000	2005	2010	2018	2019	2020
Nuclear	8.4%	7.8%	6.3%	7.4%	6.5%	6.6%
Wind	0.0%	0.1%	0.4%	2.6%	3.0%	4.0%
Solar	0.0%	0.0%	0.0%	0.6%	0.6%	0.7%
Hydro	0.2%	0.2%	0.1%	0.2%	0.3%	0.4%
Bioenergy	0.9%	1.6%	2.3%	6.1%	6.7%	7.8%
Transport fuels	0.0%	0.0%	0.6%	0.7%	0.9%	1.0%
Other	0.0%	0.0%	0.4%	0.8%	0.9%	1.0%
Total	**9.4%**	**9.7%**	**10.1%**	**18.5%**	**18.9%**	**21.5%**

In 2020 the UK obtained 21.5% of its primary energy from low carbon sources, with 37% of this from bioenergy, 31% from nuclear, and 18% from wind.

[UK Energy in Brief 2021 (publishing.service.gov.uk)]

HSE Engaging with Government

Department for Business, Energy & Industrial Strategy

Department for Levelling Up, Housing & Communities

Department for Transport

Maritime & Coastguard Agency

Environment Agency

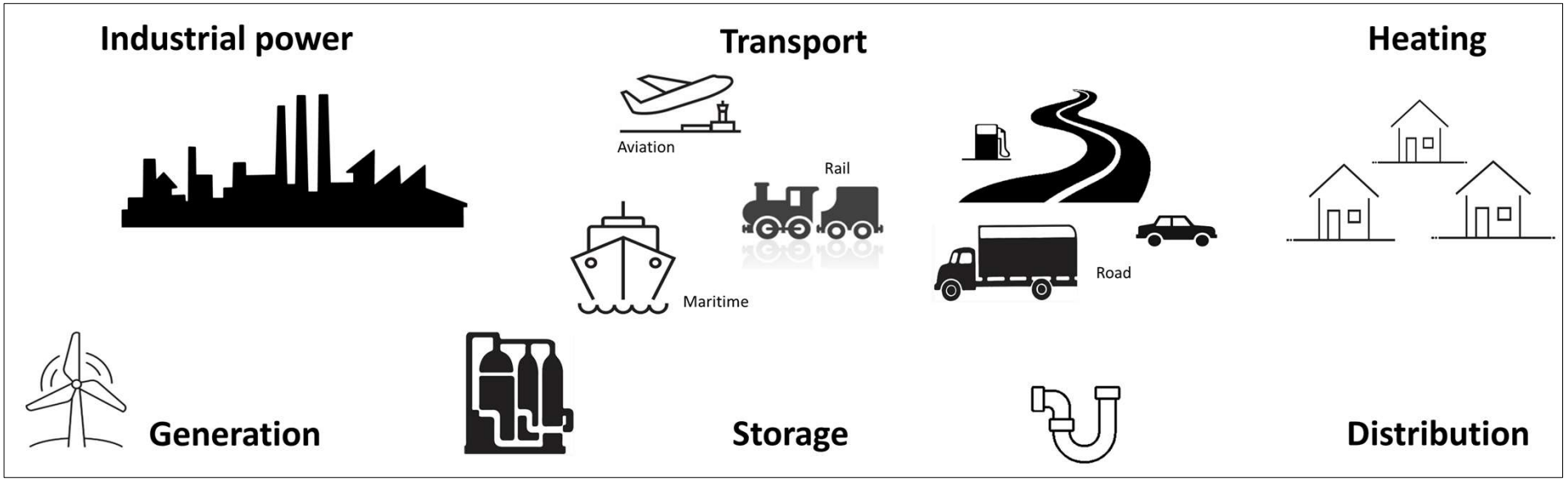
ofgem

Cyfoeth Naturiol Cymru Natural Resources Wales

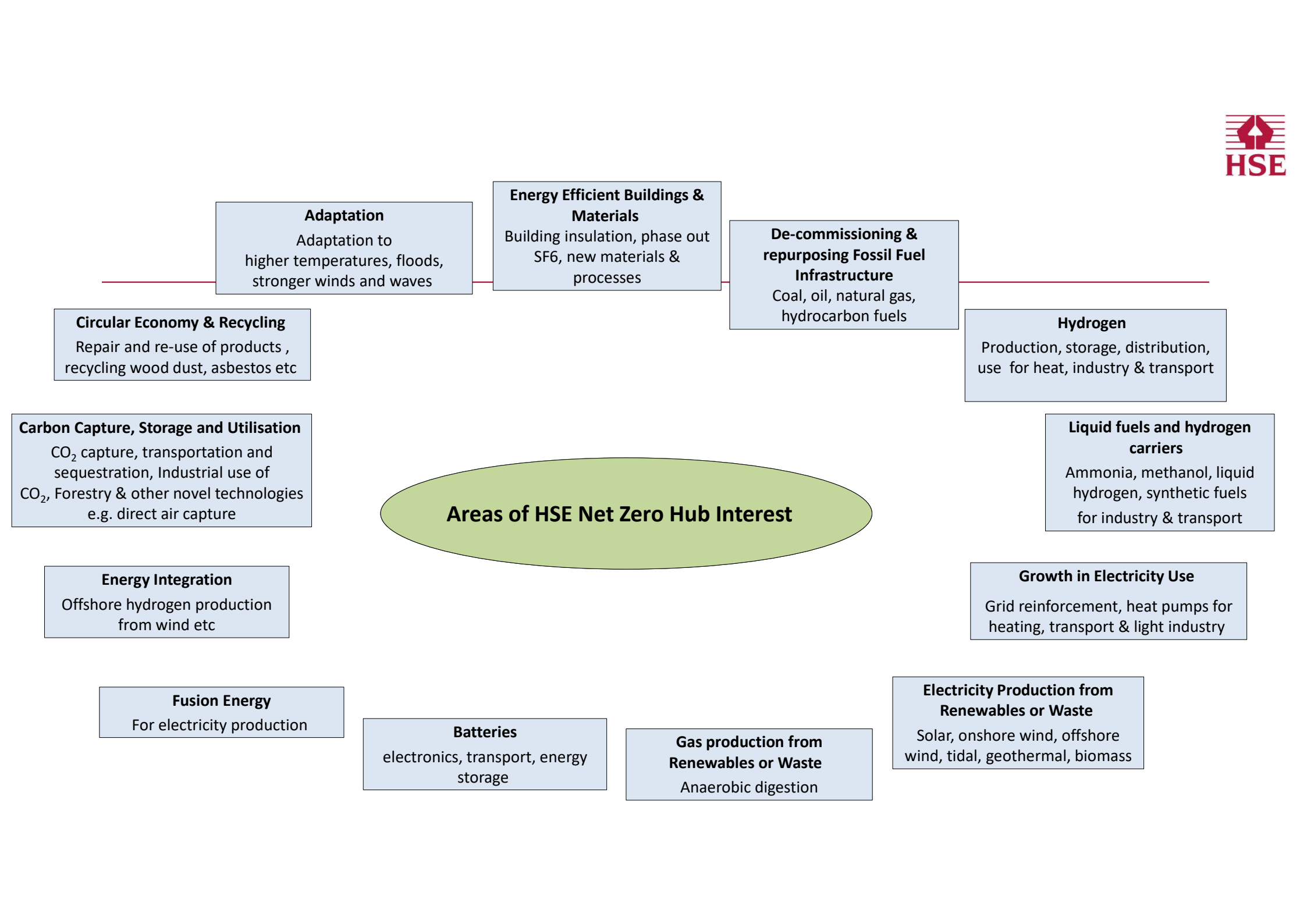
SEPA Scottish Environment Protection Agency Buidheann Dìon Àrainneachd na h-Alba

UK Civil Aviation Authority

HSE Engaging with Industry



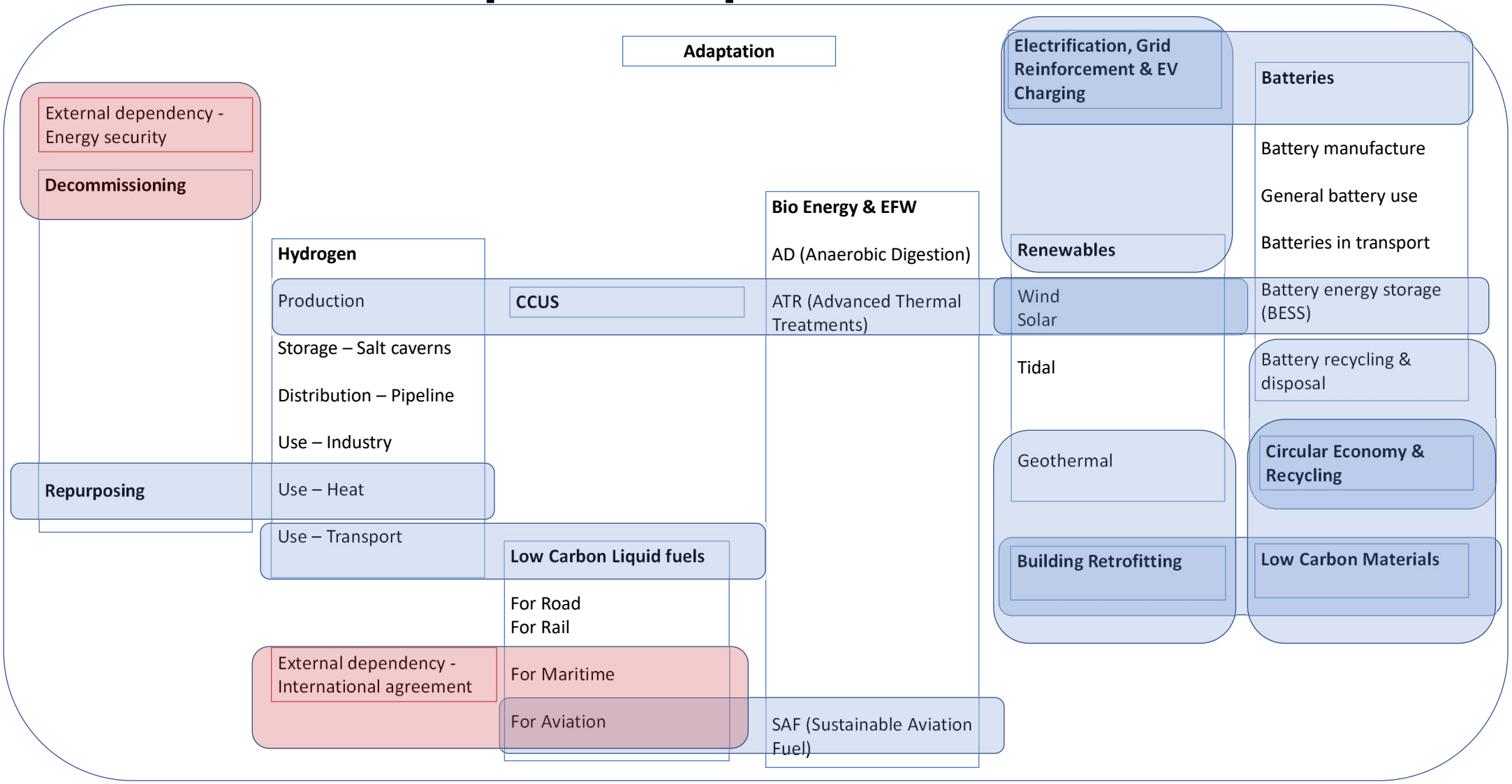
HSE Net Zero Hub


Areas of HSE Net Zero Hub Interest
Adaptation
Adaptation to higher temperatures, floods, stronger winds and waves
Energy Efficient Buildings & Materials
Building insulation, phase out SF6, new materials & processes
De-commissioning & repurposing Fossil Fuel Infrastructure
Coal, oil, natural gas, hydrocarbon fuels
Circular Economy & Recycling
Repair and re-use of products , recycling wood dust, asbestos etc
Hydrogen
Production, storage, distribution, use for heat, industry & transport
Carbon Capture, Storage and Utilisation
CO_2 capture, transportation and sequestration, Industrial use of CO_2, Forestry & other novel technologies e.g. direct air capture
Liquid fuels and hydrogen carriers
Ammonia, methanol, liquid hydrogen, synthetic fuels for industry & transport
Energy Integration
Offshore hydrogen production from wind etc
Growth in Electricity Use
Grid reinforcement, heat pumps for heating, transport & light industry
Fusion Energy
For electricity production
Batteries
electronics, transport, energy storage
Gas production from Renewables or Waste
Anaerobic digestion
Electricity Production from Renewables or Waste
Solar, onshore wind, offshore wind, tidal, geothermal, biomass

Ongoing Engagement with Net Zero Technologies

Policy	Science	Standards & Regulations	Collaboration & Communication
Background Technology solutions & links to net zero, historical context, HSE statutory responsibilities and the responsibilities of others	**Safety & Health Issues** Known or emerging safety AND health issues	**Standards & Guidance** Availability of national and international standards and guidance	**Key Stakeholders** Key stakeholders or stakeholder groups, national and international regulatory alignment
Policy Position Fit to overall Government strategy, financial drivers and specific asks & concerns from OGDs and LAs	**Research** Completed research, outstanding research questions, evidence gaps and ongoing work	**Duty holders** Future numbers and competency of duty holders	**Communications** Evidence of any areas of concern
Industry Perspectives Views from industry and how they see different areas developing	**Experience from Inspections & Incidents** Intelligence from inspections and incidents nationally and internationally	**Regulations** Effectiveness of regulatory coverage at controlling future risks	**Events** Net zero events
Deployment Milestones First planned deployment, deployment milestones and any geographical context to market growth			

HSE Net Zero Topics – Dependencies

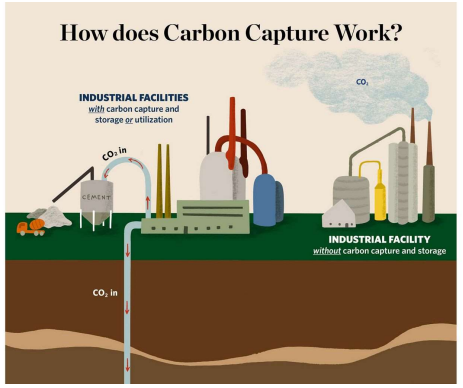


Net Zero Technology Areas

Hydrogen

- Only real experience of grey hydrogen production to date
- Multiple regulations (COMAH, HSC, PSR, PCR, CDG, DGHAR, GSMR) and co-regulators (EA, SEPA, NRW, OPRED)
- Hydrogen production and utilisation markets being incentivised to grow at the same time
- Blue hydrogen production coupled with CCS linked to clusters
- Green hydrogen production (few current examples, incentives this year, deployment more quickly, maturity of electrolyser technology a challenge, scale up to 1GW by 2025)
- HHP looking at policy decision for hydrogen for heat by 2026
- Transport by new pipelines and road

Carbon Capture, Usage and Storage



- CO_2 captured, pressurised and transported (pipeline or ship) then injected underground for storage on a permanent basis
- Unproven in practice at scale in the UK
- Cluster sequencing process initiated in May 2021, construction due to commence in mid-2023 with ambition for commissioning in 2025
- Two track-1 clusters (HyNet & East Coast Cluster) with reserve cluster (and other clusters)
- Known risks include presence of toxic, flammable and explosive substances such amines, ammonia, oxygen PLUS more novel handling of CO_2 in gas, dense and supercritical phases
- HSE had scientific engagement during previous round of government funded demonstration projects
- Review of existing regulatory framework

Batteries

- Interest in battery safety is broad:
    - Manufacture
    - Aspects of use (In vulnerable areas e.g. Offshore/ mines)
    - Charging (In vulnerable areas e.g. high-rise buildings)
    - Battery Energy Storage Systems (BESS)
    - Maintenance
    - Recycling and disposal of batteries
- Mainly focused on Lithium-ion batteries (commercialisation of other battery technologies 3-5 years away)
- Electrification of industry and transport = massive increase in batteries for vehicles and energy storage
- Li-ion batteries pose electrical risks + fire and explosion risks and toxic risks
- Challenges for emergency response
- COMAH and HSC apply to aspects of battery manufacture and recycling process
- Currently no battery recycling facilities in the UK, but some planned and increase in demand likely

Renewables – Wind Energy

- Government commitment to quadruple offshore wind capacity from 2020 levels by 2030 with the aim to produce 40GW of offshore wind, including 1GW of innovative floating offshore wind
- At start of 2020 there were projects totalling 4.4GW of offshore wind in construction (over 500 turbines)
- Currently regulate using HSWA and CDM Regulations (No specific wind energy regulations)
- Significant construction risks in a challenging environment combine with O&G installation risks, e.g. ship collision, helicopter crash, evacuation challenges

Renewables – Geothermal

- Existing borehole regulations only cover oil and gas extraction
- Boreholes now being sunk for other reasons including hot water (geothermal energy) and for warm air (heat pumps)
- Likely to be a growth in this area particularly related to heat pump installations

Liquid fuels & hydrogen carriers

- New low carbon liquid fuels needed to decarbonise heavy transport, shipping, aviation, road and rail
- Various fuels being explored including ammonia, methanol, liquid hydrogen as well as synthetic fuels – but no clear strategy at the moment
- Also potential for growth in hydrogen carriers
- Starting with lower carbon fuels that are compatible with existing engines (e.g. SAF)
- HSE interest related to production, storage and distribution (by pipeline & road in the case of their being dangerous goods) not when they are used in vessels or in aircraft
- Some complexities to regulatory boundaries particularly in areas such as ports
- Highly likely that new COMAH sites will be created when low carbon liquid fuel infrastructure grows

Bioenergy & Energy from Waste

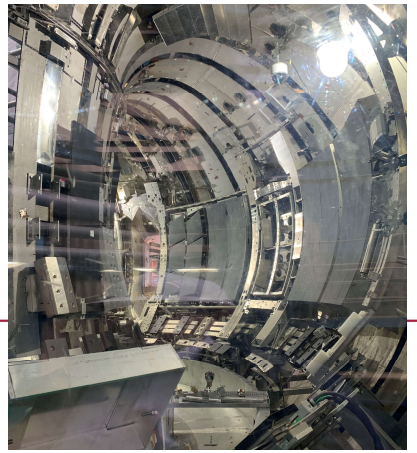
- Mix of technologies including more mature technologies like AD and biomass power stations to novel Advanced Gasification Techniques (AGTs) including gasification and pyrolysis
- Government incentives e.g. feed in tariffs, support schemes, but also driven by the circular economy
- Appear in a number of sectors including wastewater treatment, recycling, manufacturing, agriculture
- In 2015 there were approximately 100 sites, by 2021 this had grown to 642 sites
- Two recent serious incidents with AD (4 deaths and 2 life changing injuries) - HSE priority area

Decommissioning & Repurposing

Topic background

- Substantial legacy of fossil fuel infrastructure will become redundant over the coming decades
- Infrastructure will either be Decommissioned (dismantled and disposed of) or Repurposed (used for something else) or Re-used (used in a new location)
- Regulatory interest in decommissioning and repurposing spans across HSE (ED offshore/ onshore, CEMHD onshore, CD due to construction risks)
- Collaboration between ED and CD to develop offshore decommissioning strategy (2017-2020) and now BAU with no major incidents offshore and 1 fatal / 2 serious injury in demolition yards onshore
- Collaboration between CD and CEMHD to develop onshore decommissioning strategy for COMAH sites at pilot stage
- Repurposing e.g. for hydrogen or CO_2 poses a wide range of technical challenges

Fusion Energy



- Fusion power worked on experimentally for over 40 years however with net zero ambitions the interest in fusion power has grown
- Government STEP [Spherical Tokomak for Energy Production (STEP) Programme] commits to a publicly funded fusion power plant in the UK by 2040 location selection autumn 2022
- Ongoing technical challenges
- Green paper and consultation concluded that HSE should remain the regulator for fusion

Building Retrofitting

- Retrofit work is required on approximately 27 million homes to bring them up to the required energy performance standards by 2050
- ‘Fabric first’ approach including insulation to the floor, cavity wall, external wall, internal wall, loft and roof, windows, doors and fittings - exact combination of these measures is dependent on the individual building
- New heating solutions including heat pumps will also be required for all properties

Adaptation

- COMAH Strategic Forum looking at guidance for COMAH operators
- G7 interest as part of Employment Taskforce under German Presidency
- Opportunities to collaborate as part of G7 OSH Network – workshop to prioritise key areas of focus regards effects of climate change on worker safety & health led by Canada in 2024

Hydrogen Heating Programme

Hydrogen Heating Programme

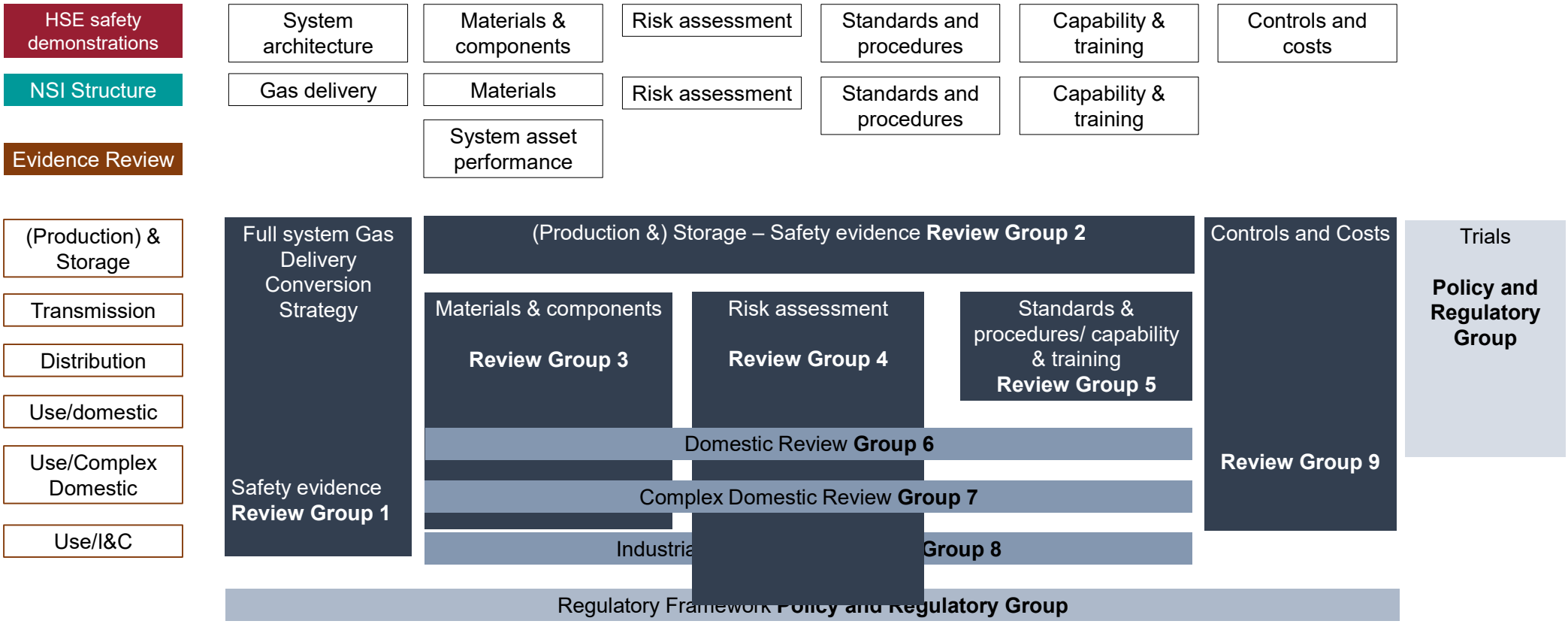
Background

- The increased use of hydrogen is a Government priority to achieve a lower carbon future, aligning with the Government's 10-point plan, sixth carbon budget and British Energy Security Strategy
- HSE have been engaging with Government departments and industry looking at the potential use of hydrogen in the gas network .
- HSE's role in the provision of safety assurance for Net Zero innovations, such as the Hydrogen Heating Programme is key to their success and acceptance

Memorandum Of Understanding - Support to Hydrogen Heating Programme

- HSE will reach an authoritative view on the safety impacts of using 100% hydrogen for heating across the UK, to feed into Government policy decisions by the mid-2020s.
- This will include assessing the evidence and regulatory framework required for the safe distribution, storage and use of hydrogen gas in domestic, industrial and commercial premises, and contribute to policy proposals for widespread implementation.
- We will utilise expertise across HSE, engage with key stakeholders and work with industry and BEIS to guide the development of an appropriate evidence base, including supporting the programme through regulatory oversight and delivery of hydrogen trials.

HSE Structure for Reviewing Evidence



Evidence Base: Hydrogen Trials

- HyDeploy (Hydrogen blending)
- Hy4Heat
- H21

Upcoming Hydrogen Projects/ Trials

H100

- Village Trial
- Industrial Clusters

Hydrogen Evidence

- There are a range of uncertainties and evidence gaps that need to be addressed before decisions can be made about the specific role of hydrogen.
- Building on projects including Hy4Heat and H21, there is a major programme of work required to provide the evidence to support decisions on trials and ultimately policy decisions on the role of hydrogen.
- HSE are working with BEIS and Industry to define the safety evidence needs against which research and trials work may take place, and the levels of safety which needs to be met before proceeding to trials or to decisions on network conversion.

Existing Regulatory Framework

Existing regulations that apply to the current gas network **include**:

- Health and Safety at Work Act 1974
- Gas Safety (Management) Regulations (GSMR) 1996
- Pipeline Safety Regulations (PSR) 1996
- Control of Major Accident Hazards Regulations (COMAH) 2015
- Gas Safety (Installation and Use) Regulations (GSIUR) 1998

- HSE will consider the range of regulatory options available for hydrogen, including the potential for amendments to existing or development of new regulations.
- There will also need to be ongoing development of codes and standards.

Next Steps

- Ultimately, HSE aims to reach an authoritative view on the safety of hydrogen to feed into a Government policy decision on the future of hydrogen for heating.

- We will continue to collaboration across Government, and with other regulators and industry to agree the evidence needed, and who is best placed to take forward relevant projects.

Hydrogen Research

HSE Science and Research

Role of Hydrogen

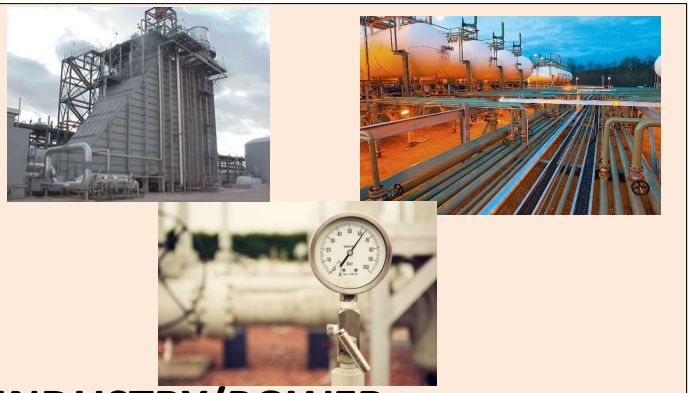
TRANSPORT

Cars & Buses – Operational in UK now.
Rail - Commercial service operational in Germany now, expected in UK in 2023.
Trucks & HGVs – Operational in US & China.
Shipping – LH2 carrier launched in Japan.
Aviation – ATI & Fly Zero.
***KEY PROJECTS**: **HyTunnel CS** – Safety in Confined Spaces, **PRESLHY** – Safe use of Liquid Hydrogen (LH2), **SH2IPS** – Maritime H_2 Safety.*

HEAT

- 85% UK Homes on gas grid.
- UK leaders on topic.
- Prototype H2 boilers already developed.
- HyDeploy operational since Autumn 2019.

***KEY PROJECTS: HyDeploy** - 20% H_2 in NG, **H21** – 100% H_2 in repurposed gas grid, **H100** - 100% in new grid, **Hy4Heat –** In homes.*

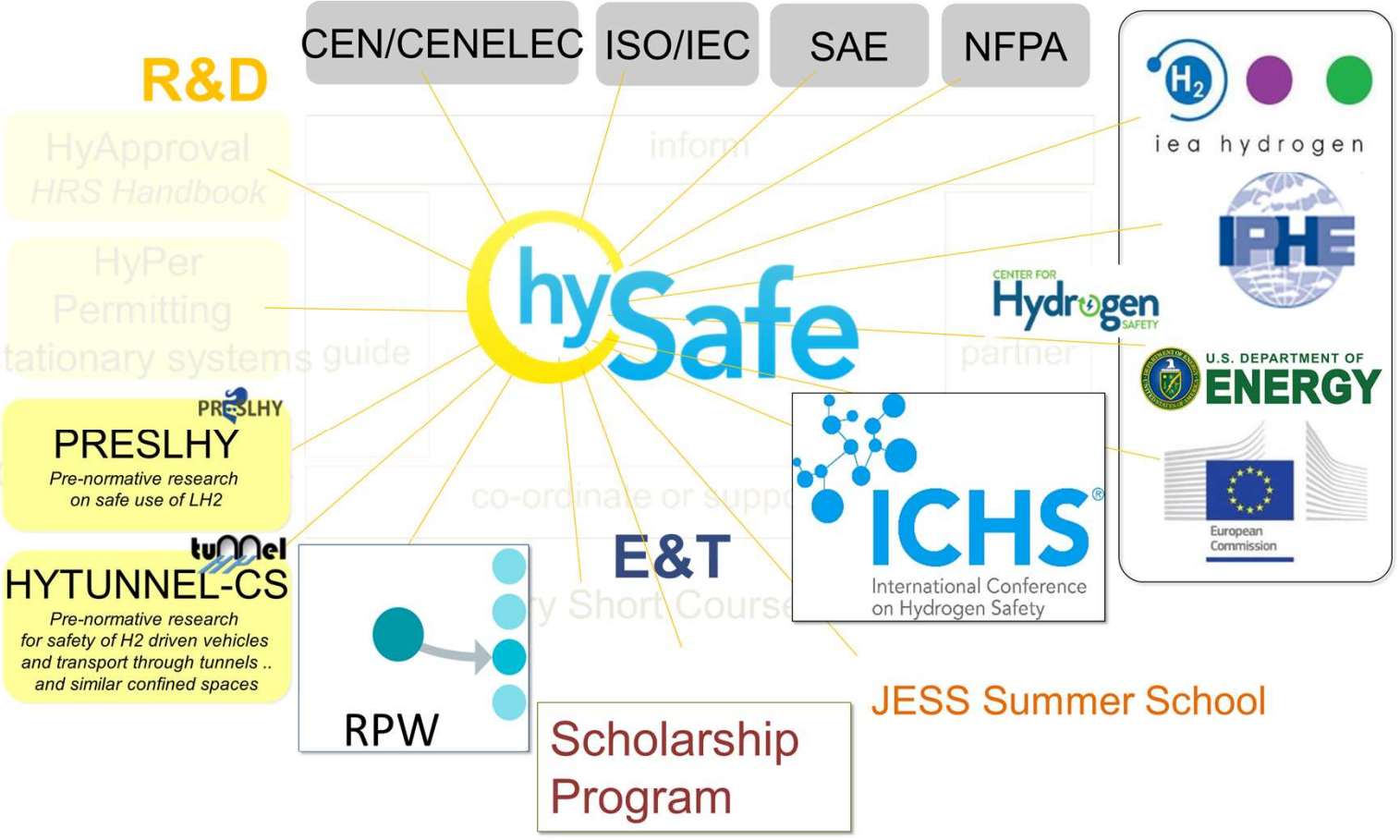


INDUSTRY/POWER

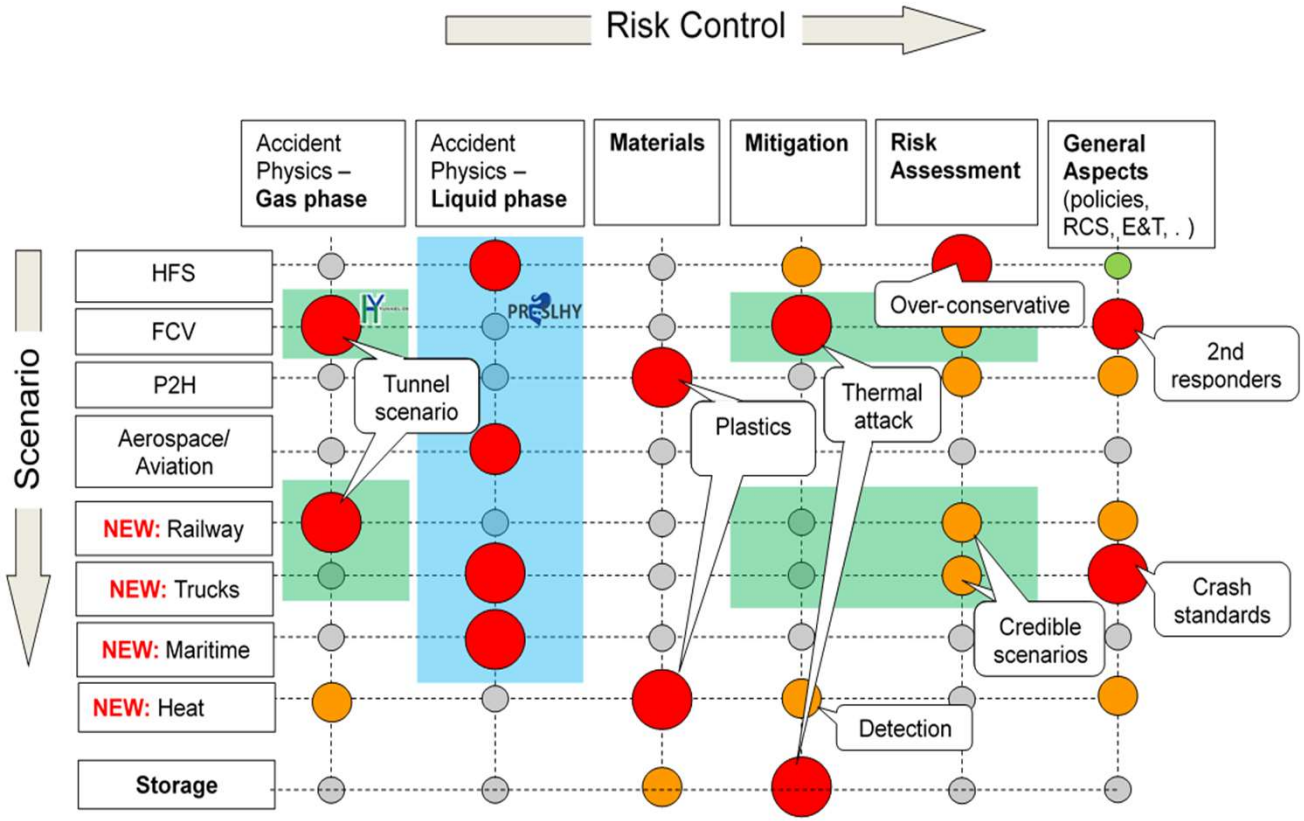
- Build on progress already made.
- Hydrogen offers energy storage options – Salt Caverns & LH2.
- At core of H_2 clusters.
- Carbon Capture and Storage a key element .

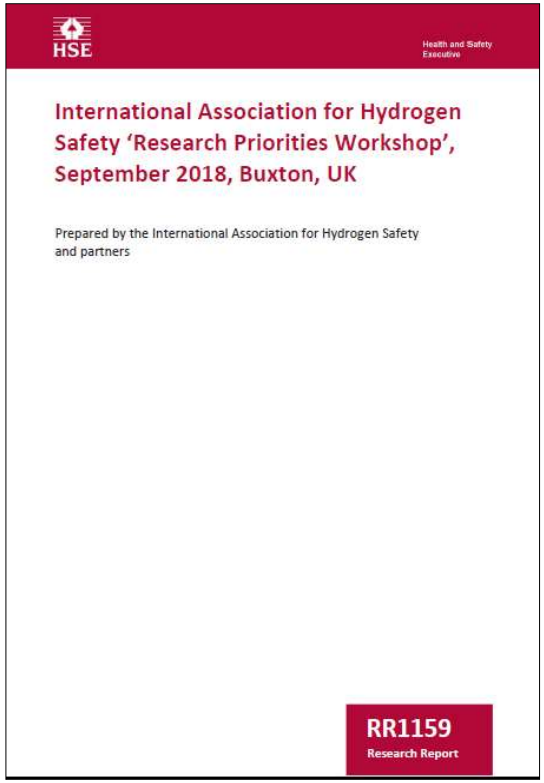
***Key Projects: High Hydrogen Project –** Safety of H_2 CCGTs & CCGEs**, HyNet** - Mersey Bay, **Acorn Project** – St Fergus, **Humber Project, Project Cavendish –** Isle of Grain*

International Focal Point for Hydrogen Safety Research



Research Priorities





https://www.hse.gov.uk/research/rrhtm/rr1159.htm

Contacts

Sally Lloyd Davies

Head of Major Hazards Policy Unit and Net Zero Hub
Regulation, International and Major Hazards Policy Branch (RIMHPB)
Sally.lloyddavies@hse.gov.uk
Direct: +44 (20) 3028 3160

Catherine Spriggs

Net Zero Programme Manager
Regulation, International and Major Hazards Policy Branch (RIMHPB)
Engagement and Policy Division
Catherine.spriggs@hse.gov.uk
Mobile: +44(0)7584 889304

Kate Jeffrey

Net Zero Industrial Cluster Lead
Regulation, International and Major Hazards Policy Branch (RIMHPB)
Engagement and Policy Division
Kate.jeffrey@hse.gov.uk
Mobile: +44(0)7584 889609