HENRY ROYCE INSTITUTE

ROYCE

THE ROYCE HYDROGEN ACCELERATOR: 5 REASONS WHY IT'S NEEDED

1. BUILDING ENERGY RESILIENCE AND REACHING NET ZERO

Recent major geopolitical events have emphasised the need for the UK to build its energy resilience. Climate change and carbon-mitigating policies mean that any investments in energy generation need to contribute towards net zero. Hydrogen's use as a fuel source enables the large-scale storage and use of energy from renewable, variable sources, including the UK offshore wind resource.

Hydrogen will play a part in decarbonisation, particularly of energy-intensive sectors and foundation industries like heavy goods transport, aerospace, marine, and manufacturing. Hydrogen energy supply chain technologies will be an integral part of a future energy system that is resilient and renewable.

Materials that enable this supply chain will play an integral role in securing a resilient future energy system in the UK.

The RHA will deliver the specific materials solutions – developed by the UK R&D ecosystem – required for an end-to-end hydrogen supply chain that enables the UK's net zero ambitions.

2. ADVANCING THE MOST CRITICAL TECHNOLOGY AREAS

The limits of materials capabilities are creating barriers to growth across the hydrogen supply chain, from production and storage to distribution, use, and operational monitoring. The UK needs to scale its hydrogen capabilities, and Royce has worked with industry and academia to identify the major materials technology challenges that are preventing this.

HYDROGEN MATERIALS CHALLENGES	
Production	• Materials-led solutions to radically improve performance, reduce cost, and extend operational lifetimes of green electrolysis routes (e.g., low or no Iridium anodes for PEM electrolysis).
Storage	• Robust structural materials for hydrogen storage at scale for fixed and mobile applications.
Distribution	• Materials capable of sustaining the thermal and mechanical strains for compressors compatible with moving hydrogen at required volumes through gas networks and in fuelling systems. • Materials to deliver and monitor hydrogen purification for end-applications from fuel switching to fuel cells, such as novel membranes and electrochemical pumps. • Materials to provide integrity assurance for large scale hydrogen transport through gas networks, such as functional coatings.
End-use	• Materials capable of handling hydrogen from extremely low temperatures – in liquid form – and at temperatures to more than 1,000°C, for making glass and ceramics, and powering ships, trucks, and planes, such as high temperature alloys.
Operational monitoring	• Smart materials for real-time monitoring of critical infrastructure and ability to report, mitigate or resolve problems before or as they arise.

The RHA will guide the funding and focus of materials R&D activities in the UK to resolve these specific challenges.

3. COMPETING IN A GLOBAL MARKET

There is an urgent need for the UK to take action now to match the investments of other countries and maintain its globally competitive position. The pace of global progress on hydrogen technologies is increasing, and if we do not act now, the investment opportunity will disappear overseas. The US Inflation Reduction Act and the EU Green Deal Industrial Plan are just two high-profile examples of international incentives that pose direct threats to investment and growth in the UK.

The UK has unique strengths in its world-leading R&D capabilities (world class universities, robust IP legislation, and labour skills), extensive offshore wind energy sources, a distributed gas network, policy precedents, and its status as a leading financial hub. These strengths prime the UK to become a key player in the adoption of hydrogen.

Materials R&D provides the innovative solutions at critical points across the supply chain to realise hydrogen commercialisation at scale and pace. Growth of this supply chain will create more skills and R&D capabilities in the UK, helping to maintain its globally competitive position as a science and technology leader.

The RHA will build the capabilities to jump-start hydrogen materials development with a clear focus on scaling these technologies to commercialisation in the UK.

4. CAPTURING THE LIFETIME VALUE OF THIS R&D IN THE UK

Once the UK's R&D ecosystem has created solutions to these real, high-value, transformational challenges, they must be translated into real economic value for this country.

The UK already has companies of all sizes across the hydrogen supply chain, including Ceres Power, ITM Power, Johnson Matthey, INEOS, bp, National Gas and Rolls-Royce. These companies benefit from otherwise curtailed offshore wind energy, which hydrogen offers the option to utilise by providing a large-scale energy storage option. The UK can build on this vibrant community to create a high-value supply chain, centred on these new materials technologies.

The accelerator will connect the R&D landscape with the UK's supply chain, demonstrators, end-users and financial institutions from the very start. The RHA's operation will be designed to safeguard R&D and commercialisation outputs for the UK.

The RHA will, by embedding stakeholder connections and structuring investment conditions, ensure that value accrues to the UK.

5. LEVERAGING INVESTMENTS TO UNLOCK A HYDROGEN INDUSTRY

The RHA board will grow to be an eclectic mix of sector leaders in industry, academia, and government. This support will build confidence in investment.

The board knows that institutional, private equity and sovereign wealth funds are increasingly looking to invest in emerging technologies that will enable critical applications in future energy systems.

These investments have the potential for high returns, and will also create a ripple effect of increasingly significant investment opportunities as they enable a full hydrogen supply chain that is exploitable in the UK and exportable globally. In 2050, the total addressable market for green hydrogen will be worth over US$1 trillion globally (Goldman Sachs), €120 billion in Europe (Aurora), and £13 billion in the UK (BEIS).

The RHA has identified in excess of £150 million worth of investment opportunities for hydrogen materials in the UK, including:

- £50 million in materials discovery.
- £100 million in accelerating novel materials into end-use applications.
- £25 million in research challenges for large-scale storage and distribution infrastructure.

The RHA will create specific, compelling and de-risked investment propositions through the engagement of the critical hydrogen economy decision-makers: industry, academia, investors, and government.