

# Written Evidence Submitted by PA Consulting and Reaction Engines

## (HNZ0077)

### About us

PA Consulting and Reaction Engines are in discussions with the transport industry to support producing a Hydrogen strategy for transport and making a case for funding a Transport Consortium led end-to-end supply chain project. A Transport Consortium has been set up to show support & public backing from companies across the Aviation/ Aerospace, Maritime, Rail and Road industries. We have tested this across the industry and there is a lot of positive support and interest.

PA Consulting are an innovation and transformation consultancy with over 3,200 specialists in consumer, defence and security, energy and utilities, financial services, government, health and life sciences, manufacturing, and transport. Our people are strategists, innovators, designers, consultants, digital experts, scientists, engineers and technologists. We operate globally from offices across the UK, US, Europe and the Nordics. PA Consulting's input is being led by Kim McCann, Sustainability and Aviation Fuels Expert at PA Consulting.

Reaction Engines are a British technology business. Their experienced material technicians have the all the capabilities they need to develop bespoke prototypes in-house. They create pioneering applied technologies that have the potential to change the face of a wide range of commercial industries – from aerospace and automotive to energy. Reaction Engines' input is being led by Simon Henley, Adviser to Reaction Engines and the Immediate Past President of the RAeS.

### Introduction

In Europe, the past 6-12 months have shown a significant growth in the development of Hydrogen fuels and as an island nation, the UK, at the heart of global supply chains, is at risk of falling behind and being dependent on other nations for the future of its hydrogen supply and technology.

**The time to act is now.**

While transport is currently small, it is being left behind by other industries in terms of decarbonisation efforts. Especially for harder to decarbonise segments of the transport industry (i.e. Aviation and Shipping), investment needs to happen now to have an impact in the next 10 years.

**This discussion paper has been prepared to show how to;**

- a) develop a demand led UK Hydrogen strategy for the transport sector as a matter of urgency and;**
- b) kick start first E2E green hydrogen transport projects to support and accelerate investment and development of Hydrogen fuel supply chains in UK.**

We recognise that no one solution will achieve total decarbonisation of transport, and that Hydrogen has a place amongst all-electric, hybrid-electric, sustainable fuels as technologies needed to achieve net zero or zero emission transport. However, it is in Hydrogen that we feel the UK is most at risk of falling behind. Long-term focus to turn UK's unique advantages into a clear business case for investments across government and industry, will be key to the full-scale Hydrogen strategy.

### The Situation

The schemes that have received committed funding are as follows:

- £20m in 2021 for freight trial for hydrogen/zero emissions truck technologies.
- £40m innovation funding for fuel/vehicle combinations to decarbonise construction, mining and other off-road heavy vehicles by 2030.

- £120m in 2021/2022 for hydrogen/electric buses.
- Jet Zero Council invested £15m into FlyZero as well as running a £15m competition for the production of sustainable aviation fuels in the UK.
- £20m Clean Maritime Demonstration Competition for the UK design and development of clean maritime technology, including hydrogen.

When viewed in context of the investments made globally (as detailed in Table 1 below), the list above gives evidence to the fact that the scale of funding for Hydrogen technologies in the UK is not sufficient to build the levels of Hydrogen technology the UK requires to keep at pace with other nations.

The green economy has increased in an accelerated speed caused by the COVID-19 crisis, as governments are requesting significant actions as a price for bailouts. Examples include France and Germany, where governments are investing €7bn and €9bn respectively to save their airlines; Air France and Lufthansa. However, this money comes with requirements to have a full-scale sustainability agenda and for the industry to push forward the whole value chain. These investments are significantly higher than the funding committed by the UK government.

EU strategy published in July shows in excess of 10,000 jobs created for each Billion Euro of investment. The UK could expect benefit at levels at least similar to that of the EU, if not greater. A demand-led strategy for hydrogen in transport will encourage scale-up of production and reduced costs. However, actions to accelerate the development are needed now.

The key considerations to develop and publish the UK Integrated Hydrogen Strategy for transport are:

- Achieving net zero requires application of appropriate solutions sector by sector, targeting solutions to maximise carbon reduction from application of limited resources such as green/blue hydrogen generation capacity.
- Transport is amongst the hardest sector to decarbonise so an integrated supply chain and implementation plan for Hydrogen in that sector is key to meeting net zero targets
- The UK is seeking to invest less than other countries and is at risk to lose its opportunity to become a global leader in Hydrogen development and adaptation.

In line with this, the following actions should be taken to bolster the scale of investments in the UK Hydrogen Industry:

- Build a clear, across industry business case for investment based on identified assets and advantages.
- Build a demand profile of the UK Hydrogen market and different scenarios for future development.
- Acknowledge the UK Hydrogen industry key capabilities and develop a core capability map to highlight existing strengths and show gaps, limitations and blockers.
- Identify key stakeholders and build a cross industry/value chain development forum to enhance collaboration.
- Build an operating model and define clear ways of working for the Consortium to bring enablers to work together, align different views and identify areas of urgent development.
- Prepare a recommendation for investment for the UK Government.
- Use Hydrogen as a lynchpin between the energy strategy and Net Zero Strategy

## Global Hydrogen Landscape

As can be seen in Table 1 below, due to significant growth in the European, North American and Asian hydrogen industries over the past 6-12 months, many countries are now ahead of the UK and have already published their own hydrogen strategy and built various consortiums. European countries are using the COVID-19 crisis to accelerate the development of their hydrogen technologies.

| Overview   |             | Key Drivers 🏢   | Key targets 🎯   | Investments 💰  |
|------------|-------------|---|---|--|
| Europe     | EU          | To become the first climate neutral continent in the world by 2050. Promote the hydrogen sector and invest in new technologies, as a part of the Commission's recovery plan to mitigate effects of the COVID-19 pandemic in Europe. | Decarbonisation of sectors depending on fossil fuels and foster demand and production in end-use application sectors.   | Estimate of up to €470bn by 2050.  |
|            | Germany     | Become a global leader in associated hydrogen technologies, use the opportunity to support the German and European economy in coping with the consequences of the coronavirus pandemic.   | To use green hydrogen, to support a rapid market ramp-up, and to establish corresponding value chains. Establish and intensify global cooperation to further develop hydrogen import channels to Germany. | In June 2020, published investment plan of €7bn for green hydrogen in Germany and €2bn to build partnerships with other countries.   |
|            | France      | To have highest electrolyser capacity in Europe to 2030 and emerge from the COVID-19 crisis stronger, with a more competitive and low-carbon economy.   | Three main hydrogen focus areas where the investments will be used: industry, transport and research.   | In September 2020 the government presented an investment of €7.2bn by 2030 and a hydrogen production capacity of 6.5 GW by 2030.   |
| N. America | US          | Department of Energy H2@Scale initiative lead research for affordable hydrogen production, transport, storage and use in order to increase revenue opportunities in multiple energy sectors.  | No official national hydrogen strategy.<br><br>States with emission targets, are driving their own development (23 States and the District of Columbia have established targets to reduce emissions).     | President-elect Joe Biden's environmental proposal of \$1.7 trillion over the next ten years, will leverage additional private sector and state and local investments to total to more than \$5 trillion (share of hydrogen receiving the investment not known). |
| Asia       | South Korea | Focus mostly on domestic market to scale up demand in the transport and electricity segment. In addition to Government led actions, Hyundai is investing heavily on expanding its fuel cell production capacity.                    | Key priorities are leadership in fuel cell cars and large-scale stationary fuel cells for power generation. By 2040, aim is to have 70% of the demand met by clean H2.                                    | Through 2018-2030: Public \$22bn, private \$6.5bn.<br><br>In August 2020 government announced additional \$0.5bn additional investment for year 2021 to assist hydrogen vehicle development.   |
|            | Japan       | Decarbonise the economy to achieve net zero greenhouse gas emissions by 2050  | Prioritising the reduction of the production cost of hydrogen by international cooperation to build hydrogen supply chain and increase the scale of production.   | Annual investment for FY2020 \$0.6bn   |
|            | China       | Establishing a "hydrogen society" by aggressively driving hydrogen and fuel cell development.   | To outpace development in the EU and U.S. with a focus on hydrogen busses and trucks. Target to have hydrogen account for 10% of the Chinese energy system by 2040  | Through 2019-2023 \$17bn.  |

Table 1: Global Hydrogen Investment Landscape

## How to unblock and accelerate the Hydrogen Industry

This section provides a structured action plan on how the UK government can best prioritise the funding already announced.

To deliver at speed, the UK needs to look holistically at Hydrogen transportation fuel uses. This can be actioned in 3 distinct phases: Define, Design and Deliver, as detailed in Figure 1 below:

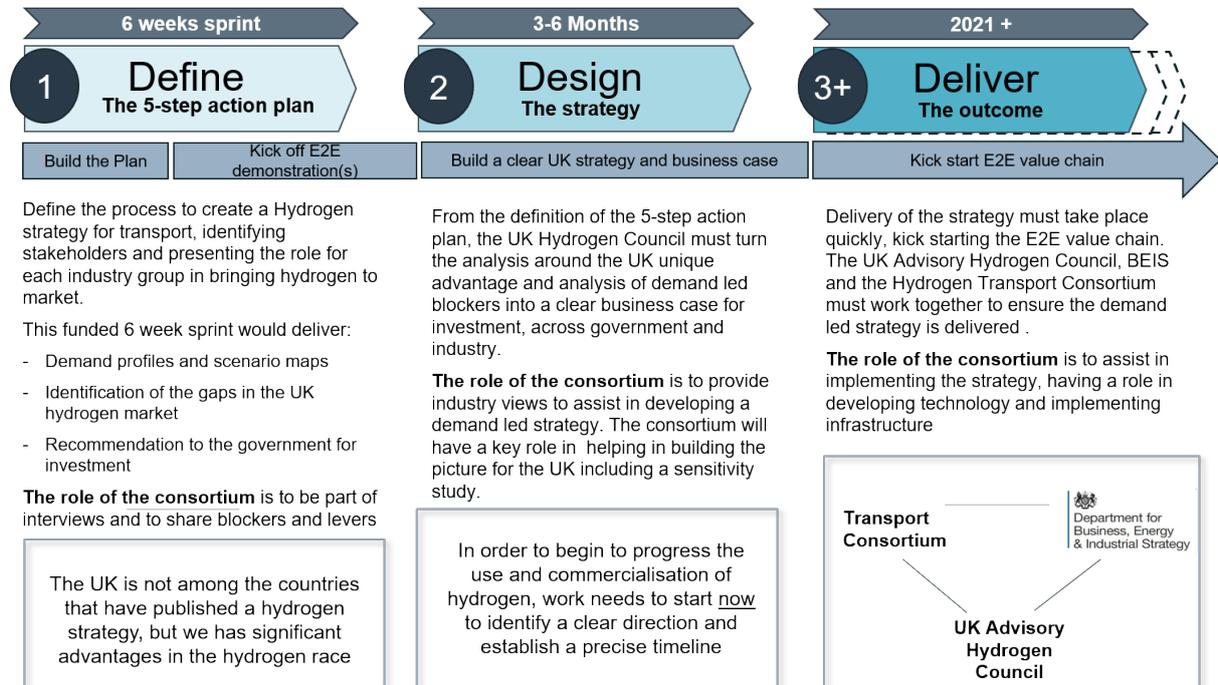


Figure 1: Details of Steps required to accelerate the Hydrogen Industry

### Step 1 – Define

The first action is to define the 5-step action plan. Focusing on what is blocking the development of a commercial Hydrogen industry, we will need to use value chain mapping & root cause analysis to really get to the core issues and their interdependencies. Using unconstrained thinking to define the best way to solve each specific core issue, we will need to identify a set of potential levers, which could be used to directly address the issues currently blocking the development of the UK Hydrogen industry

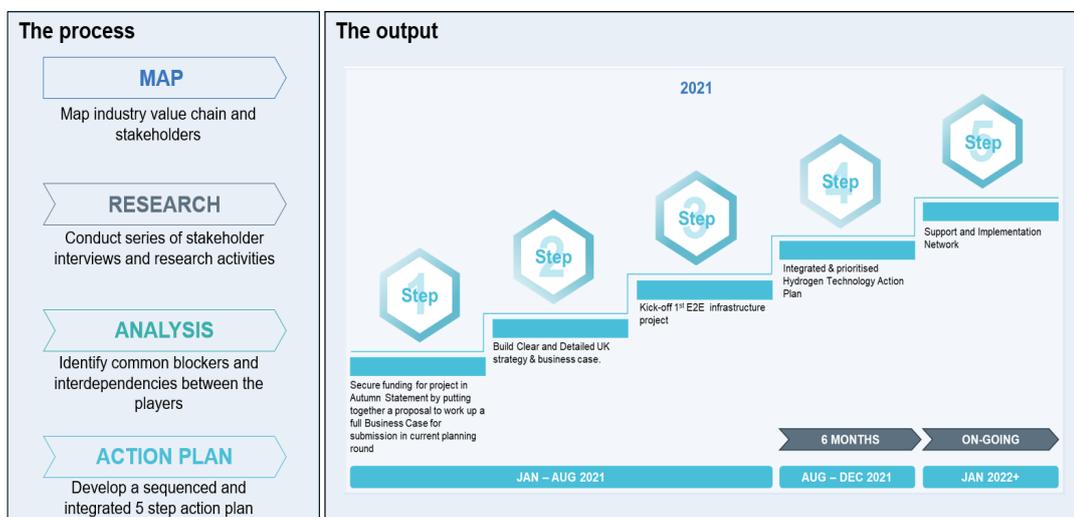


Figure 2: Proposed 5-Step Action Plan to Kick-Start the UK Hydrogen Industry

Understanding the market demand and industry strengths & limitations will be the key starting points to define three key issues:

- Demand profile and scenarios
- Gaps in the market
- Recommendation for investment

Figure 3 below presents the mapping of the value chain to build the business plan.

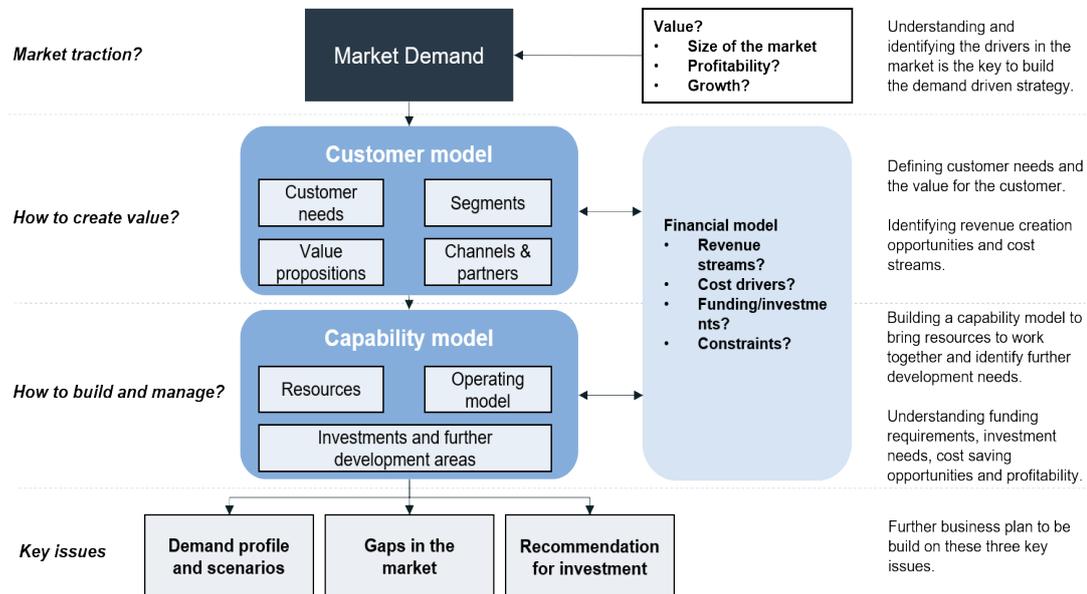


Figure 3: Mapping the Value Chain to Build the Business Plan

### **Step 2 & 3 – Design & Deliver**

After the definition of the 5-step plan, the UK Hydrogen council must look towards turning the analysis of the demand-led blockers into a clear business case for investment, across government and industry, leveraging the UK’s unique advantage as an island nation with global trade. This will need to be not only with a national lens but also with a regional perspective to identify how and where the UK regional hubs should develop. This will feed directly into the development of the demand-led strategy.

The delivery of this strategy must then be undertaken quickly to kickstart the E2E value chain. This must be undertaken through the combined effort of the UK Advisory Hydrogen Council, BEIS and the Hydrogen Transport Consortium to ensure that the demand-level strategy is delivered.

### **Call to action**

For the UK aerospace industry to maintain its market share and continue to have a competitive edge it must be involved in the delivery of low carbon solutions of the future. While transport will not be the largest consumer of hydrogen molecules it is imperative that it is not left behind or forgotten with the government’s strategy and the development of the hydrogen infrastructure within the UK, particularly in the difficult to decarbonise transportation areas of aviation, shipping and heavy vehicle use. The technology journey must start now to meet the UK government net zero targets. Therefore, we would propose that it is critical that the UK government strategy developed this year takes into account the future UK transportation demand and technology and infrastructure required to deliver this.

***(January 2021)***