Written Evidence Submitted by Johnson Matthey

(HNZ0056)

1. The suitability of the Government's announced plans for "Driving the Growth of Low Carbon Hydrogen", including:

- *the focus, scale and timescales of the proposed measures;*
- *how the proposed measures—and any other recommended measures—could best be co-ordinated;*
- *the dependency of the Government's proposed plans on carbon capture and storage, any risks associated with this and how any risks should be mitigated; and*
- *potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel.*

The UK is currently a world leader in hydrogen, with some of the largest and most ambitious projects across the value chain, from production to use. What is critical is that this lead is maintained, so that we can create jobs and boost local economies and so that we are able to realise the value from exporting hydrogen technology, skills, services and expertise. It is with this lens that we review the announcement from government.

The focus on Super Places is sensible as there are economies of scale to be gained and it is a concept that has benefited industry and allowed it to reduce costs via integration. Once the clusters are in place there will be spillover into the surrounding area.

Scale will always be contentious, particularly in light of some of the targets proposed by the EU and individual countries in the EU. 5GW by 2030 of a mix of green and blue hydrogen is on the low side and very achievable. In fact, the HyNet cluster has plans to deliver more than 3GW of low carbon hydrogen by 2030 from one location. However, this is a starting point that is still a large number and will allow real projects to be developed at scale. With further evidence over the coming years that target can be increased.

A target for 2030 of at least double 5GW, if not three times, is very achievable given the right actions this year. Whatever the target, be it 5GW or more, this will only be achieved by putting in place a business model to enable hydrogen projects to secure financial investment. This needs to be done quickly. For the large projects, both green and blue, that will make a material impact on net zero targets, design and build time is likely to be between 24 and 30 months. Delay in defining business models will have knock on implications for the 5GW target, the 1GW interim 2025 target and the UK position as a leader in low carbon hydrogen. Projects that government has invested in, such as HyNet, Gigastack and Acorn are world leaders due to this funding, but without the business models they will stall and momentum will be lost. We may lose the buy-in of key global companies who can invest anywhere in the world and today are supporting UK projects, but will quickly move to more attractive geographies. We would challenge whether two years is needed to deliver a strategy, consult on business models (where a lot of work has already been done) and then deliver those business models to the market. Private investment is ready to support low carbon hydrogen so government should be stretching themselves to deliver this key cornerstone earlier than currently planned.

It is right that at this stage there is no split between blue and green hydrogen and that government is pursuing a twin track approach that will allow the development of both types. Most stakeholders, including the Committee on Climate Change, are clear that we need both blue and green hydrogen to meet our carbon budget and net zero targets, and JM agrees. Coordination is key for hydrogen as it crosses multiple sectors and therefore multiple departments in government as well as teams in BEIS. The Industrial Energy group have been a welcome driving force and able to push forward as it is clear that hydrogen is one of the major solutions to decarbonising industrial processes. However, hydrogen can do a lot more and it is not clear what the BEIS Heat strategy is and what role the DfT is playing despite hydrogen being a key solution for HDVs and a critical part of the green ammonia solution for marine. A single minister should be mandated to coordinate and drive the implementation of hydrogen.

CCUS will be critical for low carbon hydrogen (blue hydrogen) to be produced at scale at clusters to provide 100sMWs to GWs of clean hydrogen in the 2030s while technology for producing green hydrogen scales up. The UK has some of the best locations for CCUS as well as the skills and know-how from the North Sea oil and gas expertise. CCUS is also an important pillar in the path to net zero but becomes increasingly essential to enable low carbon hydrogen. Currently business models are under development within BEIS and there is a good level of coordination with those for hydrogen, which needs to continue. In fact, the business models for CCUS are somewhat further advanced, although it will take longer to build the infrastructure than it will a hydrogen plant so the timings could work well if government proceeds as rapidly as possible with both. What will destroy both CCUS and low carbon hydrogen will be a last minute government withdrawal of funding as was seen in 2015, as this would shatter any confidence that has slowly been rebuilt.

To achieve its potential, the economics of the hydrogen economy need to work. That means getting the business model right, so hydrogen production works for the plant operators and the consumer. In the medium term, an appropriate carbon tax will mean that hydrogen is at cost parity with current fuels, such as Natural Gas. However aggressively increasing carbon tax in the short term to kick start hydrogen production would have a negative impact on the UK's industrial base that competes in a global marketplace. The outcome would be to offshore UK manufacturing leading to loss of jobs and increasing CO_2 emissions via importing products with higher embedded emissions.

The UK's Hydrogen Strategy must therefore contain a proven funding model to support businesses with the OpEx costs of hydrogen production. We believe that the best solution is a Contracts for Difference (CfD) model, which will encourage private investment in the upfront CapEx costs associated with delivering new hydrogen facilities and, over time, drive down the cost of hydrogen by competition, thus delivering better value to the taxpayer/consumer. It is important that standards are set for access to the subsidy models, with one key factor being a requirement that hydrogen production will ultimately be low carbon. For blue hydrogen a minimum threshold of 95% CO2 capture should be set and it must be clear that a green hydrogen project will ultimately be 100% powered by renewable electricity.

This is a pragmatic approach, based on what we know to work. The CfD model has been a success for offshore wind – driving down costs by encouraging innovation and efficiency – that has made the UK a global leader in the deployment of this technology. The time to make decisions on supporting hydrogen is now. Designing a new funding model will take too long to implement and is not guaranteed to be a success. This approach will impact business confidence and potentially result in the UK missing out on the hydrogen opportunity.

Beyond Johnson Matthey, it has the widespread support of industry, and is proposed by groups such as the APPG for Hydrogen and more recently in Frontier Economics' research for BEIS on Business Models for Low Carbon Hydrogen Production.[1]

Putting it in place the right way will be important too. A phased approach will work best, with individual contracts in place to begin with to allow price discovery, and later introduction of auctions. It will also be advantageous for blue and green to be contracted in a 'twin track' system, where both use the same contract for difference methodology but are not included in the same tendering process, as green hydrogen would not be able to compete with blue on a cost basis for many years to come.

2. The progress of recent and ongoing trials of hydrogen in the UK and abroad, and the next steps to most effectively build on this progress.

Johnson Matthey is involved in both the HyNet and Acorn projects for blue hydrogen production, which have been funded through the BEIS Hydrogen Supply Competition and will be among the leading large scale projects globally. Progress has been good and both projects could be producing large quantities of low carbon hydrogen by 2025 if the business models (as outlined in section 1) are put in place during 2021 or the early part of 2022. The other projects that were supported under this scheme are likely to be in the same position.

Projects, such as HyDeploy[2], H100[3] and H21[4] are important proof statements to allow policy to permit clean hydrogen in the gas grid, which is needed to lead to the use of significant volumes of clean hydrogen, as one of the front-runners in the use for domestic heating. It is also encouraging to hear of the DfT planning to establish an all-hydrogen bus town, which will provide the UK with world-leading insights into the deployment of hydrogen at scale in depot-based transport applications. This needs to be implemented.

It is important to understand that projects have momentum – business buy-in, teams assigned and committed. Losing momentum can have serious consequences for projects, such as overspend or even a change in priorities meaning a project is no longer viable.

3. The engineering and commercial challenges associated with using hydrogen as a fuel, including production, storage, distribution and metrology, and how the Government could best address these.

There are no engineering constraints on deploying production of low carbon hydrogen today. The commercial challenges are detailed above and are the current barrier to deployment. It should be noted that hydrogen distribution for industrial use via pipeline is very well known and deployed in many locations around the world. There are also locations in the UK that store hydrogen today. The challenge is the scaling up of these requirements to meet the likely requirements in the 2030-2040s.

Allowing the transportation of hydrogen via the existing natural gas pipelines will be the lowest cost option, but again we are likely to need a range of options from tube trailers, tankers, local production, blending in natural gas to 100% hydrogen pipelines.

---

[1] http://www.frontier-economics.com/uk/en/news-and-articles/news/news-article-i7615-the-future-of-low-carbon-hydrogen-production/

[2] https://hydeploy.co.uk/

[3] https://sgn.co.uk/about-us/future-of-gas/hydrogen/hydrogen-100

[4] https://www.h21.green/

4. The infrastructure that hydrogen as a Net Zero fuel will require in the short- and longer-term, and any associated risks and opportunities.

The infrastructure required will be determined by the end use application and the scale of production. For industrial processes at large scale using 100% hydrogen it is likely that dedicated hydrogen pipelines will be the solution. At such clusters providing hydrogen for hydrogen refuelling stations (HRS) will make sense and these can be co-located with distribution centres for fuelling HDVs. Distribution centres can also use hydrogen internally for forklift trucks, a niche market that already exists. Away from large clusters it is likely that smaller scale production via electrolysers will be required at HRS to provide the coverage of refuelling points. In EU countries such as Germany there are clear targets for the number of HRS that will be required to allow the roll out of vehicle fleets. Without the infrastructure in place the OEMs will not view the UK as an attractive market to focus on as there will be competition from countries for supply of the finite number of vehicles that will be produced over the next decade as production ramps up.

5. Cost-benefit analysis of using hydrogen to meet Net Zero as well as the potential environmental impact of technologies required for its widespread use.

There are a number of studies showing the value of hydrogen in a strategy to achieve net zero, such as those for the UK by the Climate Change Committee as well as global studies by the Hydrogen Council looking at the comparative costs of different decarbonisation options. For example, in the heavy duty vehicles (HDV) area, analyses of Total Cost of Ownership (TCO) are more favourable for fuel cell powered vehicles than for battery powered ones

One area that is receiving more focus is Life Cycle Analysis for the complete value chain, comparing different production methods, transport and storage as well as end use. A report will be published by the Hydrogen Council in January 2021 that will detail this and provide the opportunity to better assess the environmental impact and the level of decarbonisation that can be achieved. Of importance is that this study considers both the emissions associated with operation as well as construction.

6. The relative advantages and disadvantages of hydrogen compared to other low-carbon options (such as electrification or heat networks), the applications for which hydrogen should be prioritised and why, and how any uncertainty in the optimal technology should be managed.

There are positives and negatives for many technologies, but what is clear is that we are not going to achieve net zero without deploying multiple low-carbon options. Hydrogen can be used across many sectors some with clear proof statements and others where work is ongoing. The hard to abate sectors, such as industrial energy, HDVs (see the TCO point from section 5 above), buses, marine and flexible power generation are clear and obvious initial targets. Domestic heating is an area that is still questioned whether heat pumps or hydrogen are the best solution. Again, it is likely that both solutions will be required in different regions of the UK and over time.

It is correct that hydrogen will be less energy efficient in some processes versus electrification, but has the benefit of lower cost of storage, and in, e.g. transport applications enables greater driving range between refuelling and faster refuelling. Storage over times greater than 24 hours are also much improved and can be used to provide energy security and seasonal storage.

About Johnson Matthey

Johnson Matthey is a global science and chemicals company, and a leader in sustainable technologies. We apply cutting edge science to create technologies to solve global challenges – such as how to improve air quality, tackle climate change, conserve and optimise the use of natural resources, and address global health issues.

We have been operating in the UK for over 200 years and employ 4,100 staff at 16 sites across the UK, and around 15,000 people globally. We are integral to the UK's industrial base, for example a third of all cars manufactured in the UK have an emission control catalyst manufactured by JM and our products are used to remove sulphur from over 80% of the UK's gas supply. We invest around £200 million per annum in R&D, around 50% here in the UK, to support the development of next generation technologies to tackle climate change; from cathode materials for battery electric vehicles to hydrogen production facilities and fuel cells.

We are globally renowned for our work on new hydrogen technology.

(January 2021)