Written Evidence Submitted by Arcola Energy
(HNZ0049)

Arcola Energy is an SME that has 10 years of experience in developing and deploying hydrogen and fuel cell technologies for uses in the energy system and in transport. We are the leading business in the UK developing fuel cell electric powertrains for heavy-duty vehicles including previous and current activities in buses, refuse collection vehicles, off-road vehicles and rail.

Our response draws on extensive experience of the team in hydrogen for all applications, but will mainly focus on the role of hydrogen in transport in the context of the Governments announced plans.

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

We welcome the focus on low carbon hydrogen but note that the focus as described is largely on the production of hydrogen, albeit with some uses mentioned. Our experience to date is that production and use needs to be developed together; the business case for low carbon hydrogen requires an offtake and the business case for use requires an affordable supply. Plans to drive growth of low carbon hydrogen should include investment in both production and use, together, and at scale. In the case of heavy-duty transport, for example, this means coordinated support for low carbon hydrogen production, refuelling infrastructure and fleets of vehicles, but the principle applies to other uses of hydrogen.

With regards to scale, we note that while ambitious, the proposed hydrogen fund is smaller than comparator strategies announced by other countries, in some cases by an order of magnitude on similar timeframes. However, it is also to be expected that the scale of deployment will increase over time, as there is still a learning process to go through, and the commercial case will strengthen with time and scale, reducing the need for public support.

Development around industrial hubs is a strength of the approach. Development of hydrogen at scale is initially likely to be associated with geographical advantages or assets such as industrial capability or renewable energy resources. Co-ordination around these hubs would be appropriate, ensuring that lessons learned can be transferred to other projects and locations.

With respect to transport as a use of hydrogen, the dependency of the Government's proposed plans on carbon capture and storage is a risk with regards to customer acceptance. In our discussions with fleet customers there is a strong preference for green hydrogen from renewables, and for visible fleets there is a concern around public perception. This risk can be mitigated by balanced support for renewable hydrogen for uses such as transport and targeting hydrogen from CCS at industrial uses.

The development of hydrogen at scale is similar in many ways to the previous successful development of renewables in the UK. Long lifetime assets for both hydrogen production and use lend themselves to long-term low-cost finance with returns over many years. We anticipate that business models that package up production and use in lease or "as-a-service" offerings to customers will help to accelerate adoption. Such schemes at sufficient scale could attract significant private investment from institutional lenders or "Green Bond" funds. Government support to de-risk private sector investment could greatly accelerate market confidence and this kind of investment.

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;

The use of hydrogen in transport is probably the most advanced of all applications of hydrogen as a fuel with examples of successful fuel cell electric vehicle trials and larger deployments worldwide. Based on this experience the technology is relatively mature, both in terms of vehicles and infrastructure, with a developing supply chain of key components and robust global standards. There are a number of businesses, including Arcola Energy, now in a position to develop and deploy fleets of vehicles, particularly heavy-duty FCEVs, to meet customer requirements.

The engineering requirement is for vehicle application development, that is the transfer of existing technology to new vehicle types, rather than development of the core technologies. The next steps to build on previous progress are therefore support for development of specific vehicles to end user requirements and deployment of these vehicles in large fleets (50+ vehicles) aligned with low carbon hydrogen production at the scale of >1 tonne per day.

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;

As noted in response to Question 2, the engineering challenge is largely in development of the specific vehicle types, rather than in the core technology of fuel cell electric powertrains. Production, storage, distribution and metrology (at least for this sector) is also relatively mature and, while there is still scope for ongoing improvement, there are few specific engineering barriers to deployment of vehicle fleets.

In our experience the challenges to deployment of fleets of vehicles are mostly commercial, and to a significant extent are related to the need for scale. Cost of production of hydrogen as a fuel and cost of refuelling infrastructure are both strongly dependent on scale of deployment with a minimum hydrogen demand of 500kg per day (approximately 25 buses) required for cost-effectiveness at this stage.

On the vehicle side, high vehicle purchase costs at this stage in the technology learning curve are exacerbated by uncertainty in vehicle lifetime and residual values as there is no data yet. As with any new technology, customers also have concerns about the technical reliability risks and uncertainty in operational costs. Government should address these challenges with a mix of support for both the capital and operational costs of fleet deployments. Note that the requirement for this support will decrease rapidly as users gain confidence and experience and that early demonstration of viable business models will help to accelerate the transition to fully commercial models.

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

Our view is that heavy-duty transport represents a low regrets option for investment in low carbon hydrogen for the short term while other larger scale industrial uses are developed. The scale of hydrogen production required (>1tonne per day) is appropriate to current industry capability. Investment in fleets of zero-emission hydrogen FCEVs will quickly deliver improvements in air quality and carbon emission reductions through low carbon hydrogen production, benefits worth achieving even if other solutions and uses have a larger role in the long term.

We expect that first fleets will be captive or back-to-base operational models rather than national infrastructure which will develop over time. The infrastructure requirement is:

- green hydrogen production from renewables, preferably produced directly on fleet sites linked to new renewable generation capacity through virtual private wire or renewable power purchase agreements
- hydrogen storage and refuelling at fleet scale
- depot adaptation for fleet service and support of hydrogen vehicles.

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

It is highly challenging to make a cost-benefit case for hydrogen for a single use. The role of hydrogen is at a system level with multiple benefits to the energy system, industry and transport and with costs and revenues spread across multiple applications. It is recognised by the Climate Change Committee that hydrogen is essential to achieving Net Zero, so the question is the most cost-effective route to development of hydrogen at scale.

In our view this means developing many routes to hydrogen production at scale, and many uses of hydrogen in parallel to maximise potential benefits and spread costs across multiple sectors. We would encourage the Government to develop plans consistent with this, including uses in industry, transport, heat and elsewhere in the energy system.

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.**

Firstly, we support the electrification of transport where this is possible considering battery electric vehicles (BEV) as complementary rather than competitive to fuel cell electric vehicles (FCEV) in the transition to zero harmful emissions and Net Zero. Even in heavy-duty transport BEVs will have an important role, particularly where operators can match or evolve business operations to suit the more limited capabilities of the vehicles. For example, fleets with regular defined routes that can be matched to BEV range can and should be supported to transition to this technology.

The benefits of FCEVs include more practical and flexible operations resulting from greater range and faster refuellin. FCEVs can or will be able to match most of the characteristics of existing diesel fleets. As a result, this type of vehicle is optimal for fleets with vehicles that have greater range and payload requirements and long daily duties or a need for more flexible operations, such as one vehicle having a range of different routes and uses. Additional energy demands such as auxiliary power loads (air conditioning, refrigeration, hydraulics) are also likely to favour this technology.

In our view fleet customers will make decisions based on operational requirements and what is optimal for the business. Government support for transition should facilitate both zero-emission options, recognising the stage of development of the different technologies. While the uncertainty in optimal technology will resolve over time, this fleet-by-fleet development and realisation of short-term benefits mean that investment in zero-emission transport of both modes is a low regrets option.

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