Executive Summary of Feasibility Study into the development of a Green Hydrogen Hub

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This feasibility study has established that there is a potential opportunity for Warwick District Council (WDC) to develop a green hydrogen production and distribution station within the district. A developed facility would enable production of hydrogen for the supply of fuel to zero carbon refuse collection vehicles (RCVs) owned by the council and currently operated by Biffa. The extent of the opportunity will be determined by the council's desire or capability to develop and deliver the facility, which could be sited at a number of locations within the district, could produce hydrogen for the broader public and private sector markets and would require the supply of renewable electricity.

Decarbonisation is a key priority as part of the Climate Change Action Plan, with both the owned and contracted fleet operated by WDC targeted to be zero carbon by 2025 and 2030 respectively. Of the contracted fleet, the RCV are the most significant user of currently diesel fuel so decarbonising this fleet is a high priority. There are two main options for net zero RCVs – battery electric and hydrogen fuel cell. A battery electric strategy for RCVs could require an increase in fleet size due to battery weight and a potential reduction in available operating hours (alongside a power supply upgrade) due to charging requirements. Hydrogen fuel cell vehicles replicate the current operating structure in terms of user experience, operating hours and payload and is expected to be the RCV fuel of choice for net zero.

The current RCV fleet is new, diesel Euro 6 standard so emissions are as low as they can be for a fossil-fuelled vehicle. The replacement cycle for the vehicles schedules their replacement in 2030 which would run close to the targeted date for net zero contracted vehicles. There are retrofit technologies that could be applied to the existing fleet to commence decarbonisation once the hydrogen hub is available and operational. One such technology is the dual fuel adaptation made by ULEMCO, which injects hydrogen into the fuel mix thereby reducing diesel consumptions and tail pipe emissions and improving efficiency. A retrofit programme is recommended to be considered alongside an advanced replacement programme to accelerate decarbonisation well in advance of the targeted dates.

To fuel the RCV fleet, WDC would require a 1MW electrolyser (1 MW electrical input). This would be capable of over-production by about 20%, which would be absorbable within the business case without external hydrogen sales. However, hydrogen production lends itself to economies of scale given balance of plant, so a larger facility would reduce the overall cost of hydrogen – and thus operating cost of the vehicles. A 1MW facility would cost around £2.1m to deliver whereas a 3MW plant would cost around £3.7m.

A 3MW facility would reduce the cost of hydrogen from £12.09 to £8.11, which in the context of the anticipated upsurge in demand for hydrogen over the coming years may be worth considering. Further increases in production may potentially reduce the cost of hydrogen further. The equivalent cost of hydrogen to diesel (£1.77 per litre) as of 28/3/2022 was between £8.50 and £9 per kg. Thus, it would be possible to produce and supply hydrogen profitably whilst maintaining or reducing the cost of fuel for the fleet. It should be noted that the power price assumed in these calculations is £90 per MWh, which is a price achievable for direct connection but challenging for grid connected power.

This study carried out an extensive survey of nearby industry, logistics and partner public sector operations to assess the potential opportunity to expand the hydrogen hub to serve beyond the needs solely of the council. The findings were that broadly the market was supportive and would be interested in participating but the perception is that hydrogen vehicles are some way off and as such it would take time for demand to emerge. This will evolve over the coming years but it could be

reasonably expected that demand will grow alongside the increase in production and that vehicle manufacturers will be accelerating development – particularly given the acceleration in government policy and programmes promoting hydrogen.

Hydrogen can only be considered 'green' or zero carbon if all of the power utilised to drive the electrolysis process is renewable. Thus, developing a green hydrogen facility needs to be considered in the context of the available or deliverable renewable generation. This would likely need to be supplied through a mix of grid delivered power purchase agreements (often known as sleeved contracts, which link remote renewables to demand) and locally generated electricity delivered through the grid or directly connected renewable generation. The cost of such delivery reduces significantly with direct connection which, considering the cost of power is the largest single component (<70%) of the cost of green hydrogen, is significant.

There are a number of known potential solar PV developments in the area and WDC is in discussion with the main protagonists regarding potential offtake and / or acquisition. Gaining direct access to such developments would be advantageous to the success of a green hydrogen project and discussions are recommended to continue.

Government policy is currently very supportive of low carbon hydrogen production and there are a number of subsidy schemes that WDC could benefit from in the delivery of a hydrogen hub:

- Renewable Transport Fuel Obligation (RTFO) – this is a DfT programme the puts the onus on fuel users to decarbonise. Green hydrogen can be eligible for RTF Certificates that have a value on the market and can have a significant impact on the business case. The effect of RTFCs is a financial contribution at today's prices of around £7 per kg, which would reduce the cost of hydrogen to £5.50 and £1.52 for the 1MW and 3MW electrolysers respectively.

- Net Zero Hydrogen Fund (NZHF) – a new programme providing Development (devex), Capital (capex) and Revenue (revex) based support for low carbon hydrogen. It may be possible for WDC to bid for some or all of these mechanisms.

- Hydrogen Business Model (HBM) – this is similar to the proposed revex scheme within the NZHF and also similar in concept to the Contracts for Difference (CfD) mechanisms that have been working for some time within the renewable electricity industry. This provides unit based support for production of hydrogen. A WDC facility may be eligible for HBM although revenue based support would be a choice between RTFO and HBM.

Delivering a hydrogen hub would require significant engagement with a relatively new industry in the UK but contracting structures and processes are well understood and discussions to date have indicated that there are a number of potential private sector partners that could work with WDC. These may include:

- ITM Power
- Element2
- Watsons
- Siemens
- Motive
- Meld Energy
- NEL
- Enapter
- Bramble Energy

Operating a hydrogen hub would require a small team of technicians that would need to be available around the clock. Where operating in a merchant environment – that is when dispensing fuel beyond WDC's own requirements - there would be an increased requirement for resource to serve customers alongside the back office systems to monitor usage, dispensing and payments. When considering the scale of a hydrogen facility and who the target customer base may be, it will be important to understand the capability and capacity requirements of the council should the decision be made to build, own and operate without private sector partnership.

In terms of location, the following sites were considered: the Stratford Road depot, Harbury Lane playing fields and Greys Mallory (on the site of the proposed New House Farm development). Greys Mallory / New House Farm has been identified as the preferred site given its location close to the strategic road network (between junctions 13 and 14 of the M40), access to the grid and local renewable generation, and current plans for the local area. Further, should the facility indeed be intended for private sector participation, the Stratford Road depot and Harbury Lane fields would not be suitable given access requirements and road movements.

The local benefits of developing a hydrogen facility would be a mixture of financial, economic, social and environmental. The facility would provide a solid financial return to WDC in whichever capacity the council chooses to participate; there would be increased revenue to the area in through traffic, local employment benefits for skilled workers; climate targets would be accelerated through reduced emissions, improved air quality and greater energy / fuel security; the facility would be self-sufficient and zero carbon.

It is recommended that the potential hydrogen hub development proposed by Warwick District Council progresses to the next business case stage. Alongside this, further discussion with market is also recommended with a view to identifying potential development partners and participants in terms of vehicle provision and retrofit, power systems and renewable electricity, technology providers, dispensers and operators.