Full Business Case (FBC)

1. General Information

Directorate	Economy – Growth & Transportation	**Portfolio/ Committee**	Clean Streets, Recycling and Environment	Transport and Roads	Value for Money & Efficiency
Project Title	Clean Air Hydrogen Bus Pilot (CAHB Pilot)	**Project Code**	CA-02996-03		

Project Description

The Clean Air Hydrogen Bus pilot (CAHB Pilot) has been developed with an estimated cost of £13.440m, to ascertain the commercial viability of re-fuelling and operating hydrogen buses to contribute towards the zero emission impact required for the city to achieve air quality compliance. Utilising locally produced renewable electricity to produce hydrogen and using it to re-fuel hydrogen buses, the zero emission impact of hydrogen buses will support the Council in achieving, in the soonest possible time before 2020, the air quality compliance needed on key city routes.

The EU Air Quality Directive 2008/50/EC sets out the national targets on emission of pollutants, including nitrogen dioxide (NO2). The directive and targets emission levels are set out and implemented in England under the Air Quality Standards Regulations 2010 and 2016. Under S.82 Environment Act 1985 the Council is required to review air quality within its area and to designate Air Quality Management Areas (AQMA) where air quality objectives set out under the Air Quality (England) Regulations 2000 and 2002 and to prepare an action plan detailing remedial measures. Once designated the Council is required to develop an Action Plan detailing remedial measures to tackle the problem.

Birmingham is currently non –compliant in a number of areas of the city centre. The pressing urgency is that the Government issued the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations in July 2017 which identified Birmingham as one of the areas experiencing the greatest problem with NO2 exceedances. The Plan requires the Council to undertake assessments aimed to deliver the best option to achieve statutory NO2 limit values within the shortest possible time. The plan for tackling NO2 exceedances will need to be finalised by Summer 2018. The plan also requires local authorities to consider innovative options and new technologies to reduce emissions including; public and private uptake of ultra-low emission vehicles (ULEVs) and using innovative retrofitting technologies and new fuels to address air quality compliance as soon as possible before 2020.

With road traffic as a primary source of harmful emissions, diesel buses, are key contributors to NO2 emissions in the city, particularly on key city centre bus routes, bus interchanges and where there are multiple bus stops. Diesel buses are one of the main vehicles prioritised in every category of Clean Air Zone implementation.

Identifying emission reduction solutions that are scalable for the size of the city as a whole and have immediate impact is a priority. The use of hydrogen buses is a potential zero emission solution, if locally produced renewable electricity is used in the production of hydrogen (by using an electrolyser to combine electricity and water). However, the commercial viability of using locally produced renewable electricity in the production of hydrogen at the scale required for a fleet of buses is unknown and needs to be tested.

The CAHB Pilot will provide evidence of whether hydrogen can be produced in a commercially viable manner for use as a zero emission fuel for public transport, and measure the impact of this on emissions of routes identified with the highest emission levels, through the deployment of up to 22 hydrogen buses.

The Council have worked with Tyseley Energy Park (TEP) to attract private sector investment to develop the low and zero emission fuel hub, to support the transition of both public and private sector fleets to ultra-low and zero emission vehicles. This development aligns with the economic and regeneration local development plan for Tyseley Environmental Enterprise District, that exploits the growth in low carbon technologies and brings forward private sector investment, employment and new skills development.

A key aim of the CAHB pilot is set to test the potential of developing a hydrogen market. This will be delivered through producing hydrogen and generating demand for hydrogen at Tyseley Energy Park (TEP), a private sector development covering a 1 acre site in the Tyseley Environmental District that received full planning permission November 2016 for a low/zero emission re-fuelling hub for commercial and public sector vehicles from buses and bin wagons to vans and taxis. TEP is set to deliver hydrogen, as well as other alternative fuels including compressed natural gas/CNG, electric charging, Liquefied Petroleum Gas/LPG and Bio-diesel. The Council have worked with TEP to attract private sector investment to develop the low and zero emission fuel hub, to support the transition of fleets to ultra-low and zero emission vehicles. This development aligns with the economic and regeneration local development plan for Tyseley Environmental Enterprise District, that exploits the growth in low carbon technologies and brings forward private sector investment, employment and new skills development.

ITM Power, as a private sector hydrogen provider, have worked alongside TEP and the Council in the design and delivery of hydrogen infrastructure appropriate for re-fuelling buses to meet the same operational requirements as for diesel buses. ITM Power are set to invest in locating the hydrogen re-fuelling infrastructure and make their own arrangements with TEP to lease the site required. The £1.0m grant to be passed to ITM under a grant agreement will provide the facilities that utilise lower cost renewable electricity produced at TEP within the hydrogen production process (electrolysing electricity and water), and for it to be compressed, stored and dispensed to the buses. The pilot will develop the price modelling for commercially viable hydrogen fuel.

The renewable electricity is produced from waste wood passed through a wood gasification plant already operating on the Tyseley Energy Park site. The renewable electricity will be used within the CAHB Pilot hydrogen production process. The hydrogen buses will refuel from the hydrogen dispensers at TEP, where Planning permission has already been approved (November 2016) for the generation of hydrogen, electric, compressed natural gas/CNG, liquefied petroleum gas/LPG and bio-diesel).

<u>Why renewable energy from Tyseley Energy Park?</u>

The renewable electricity made by Birmingham Bio Power Ltd at Tyseley Energy Park provides *renewable energy from its low emission wood biomass power plant.* The plant converts recovered wood into electricity using gasification technology not burning the wood to produce electricity. The process used is a form of advanced thermal treatment of waste where the carbon-based material in the waste is converted into a gas which is used to raise steam. This is then passed through a turbine to produce electricity

Unlike conventional wood-fuelled plants, it generates electricity by combusting the syngas converted from recovered wood mass that would otherwise go to landfill. Using this renewable power produced from wood biomass generated electricity within the electrolysis process (using electricity and water) for producing the hydrogen within the CAHB Pilot has not been done before either in the UK or the EU.

With hydrogen at zero emissions, the tail pipe emissions will be 100% zero emissions. This is known at ‘Tail to Wheel’ TTW emissions. However, ‘Well to Wheel’ emissions account for the carbon emissions as a result of producing the transport fuel, in this case renewable energy from wood biomass, accounting

from the source of production to the wheel of the vehicle. The benefit of using renewable electric from the wood biomass plant as opposed to using electric from the grid is that there is a significant carbon saving. When also comparing the use of hydrogen produced from TEP wood biomass with an electric bus charged from the grid for the same bus size and distance, the difference in emissions in regard to the 'Well to Wheel' stage is as significant:

- Government greenhouse gas reporting guidelines give standard emissions factors for wood biomass – Using a figure of 55.53 kgCO2e per tonne of wood pellet[1] from the UK Government guidelines), 67,000 tonnes per year of wood pellets from the Tyseley Wood Bio mass annual data, and the annual electrical output from the plant of 72,000 MWh (mega-watts per hour), gives emissions associated with the Wood biomass electricity supply of 52 gCO2e/kWh. This compares with emissions from electricity sourced from the UK grid at an average of 412 gCO2e/kWh[1].
- Applying the 52 gCO2e/kWh to a hydrogen production efficiency of 60 kWh/kg (this is based on a central estimate for PEM electrolysis from the 2014 "Development of water electrolysis in the European Union" FCH-JU study, along with a reasonable assumption of 6 kWh/kg for compressor consumption), and a bus fuel economy of 8 kg/100 km (assumed for the Birmingham hydrogen buses) gives a per km 'Well To Wheel ' emissions figure of **250 gCO2e/km**, therefore around c. 43% saving in CO2 emissions over electric buses based on the centre of the range of electric buses using energy from the UK grid, as evidenced in the Low Emission Bus Guide http://www.lowcvp.org.uk/projects/bus-working-group/lowemissionbusguide.htm. Using referenced numbers from this study (page 20), Well-to-Wheel (WTW) emissions for electric buses are between **430-450 gCO2e/km** depending on the electric bus technology using electric from the grid.

The CAHB Pilot will provide the evidence of commercially viable hydrogen as a zero emission fuel for public transport and verify the impact of emission reduction this will have on identified routes with the highest emission levels, as a result of deploying a fleet of up to 22 hydrogen buses. This will come as a result of developing an 'eco-system' of hydrogen production from renewable electricity from waste to deploying a fleet of public transport hydrogen buses to be run commercially by a Bus Operator.

The CAHB Pilot will also kick-start a hydrogen market of supply and demand, supporting growth through supply chain development in association with hydrogen bus maintenance, servicing, fuelling, engineering parts and product design, bringing forward jobs, training and emission reductions.

The CAHB Pilot will set up through the procurement of the Bus Manufacturer process, hydrogen bus servicing and maintenance contracts. This project will align the development of associated education and training programme developments from City & Guilds level qualifications, apprenticeship training opportunities to Degree level education in collaboration with the University of Birmingham and Aston University.

Background history

The Council is responsible for air quality compliance. The EU Air Quality Directive 2008/50/EC sets out the national targets on emission of pollutants, including nitrogen dioxide (NO2). The directive and target emission levels are set out and implemented in England under the Air Quality Standards Regulations 2010 and 2016. Under S.82 Environment Act 1985 the Council is required to review air quality locally and to designate Air Quality Management Areas (AQMA), where air quality objectives, as set out under the Air Quality (England) Regulations 2000 and 2002, are not being met. The Council is required to prepare an action plan

[1] According to UK Government GHG emissions reporting conversion factors for 2016, see https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2016

detailing remedial measures within the AQMA.

With road traffic as a primary source of harmful emissions in the city, heavy diesel vehicles including buses are key contributors to nitrogen dioxide (NO2) and Particulate Matter (PM) emissions. By enabling the development of ultra-low and zero emission re-fuelling infrastructure using alternative low and zero emission fuels such as hydrogen, the Council is providing leadership in enabling public and private sector fleets to be able to eventually transition to low and zero emission vehicles and realising the ambitions of Birmingham Connected Transport Strategy to deliver Green Travel Districts, health and well-being.

As a first step, in February 2015, the Council's commissioned 'Birmingham Blueprint' study which identified the type of low and zero emission fuel technologies required by different fleets operated within public & private sector business. The study provided the baseline for the type of low and zero emission fuel technologies and re-fuelling infrastructure that would be required to reduce harmful emissions. This considered both electric recharging and hydrogen fuel and concluded that the 7-hour recharging for electric buses was impractical due to the number of buses and depot facilities. Hydrogen fuel dispenses in 5 to 10 minutes. The next steps required Research & Development studies to understand the renewable energy systems and scale of what was required; testing commercial viability of hydrogen buses and hydrogen as a zero emission fuel technology.

The Council has, since 2015, collaborated with Transport For London and Aberdeen City Council to put in place the key steps to enable the deployment of 100 hydrogen buses by 2020. The aim of the collaboration is to create economies of scale through joint planning and procurement.

Significant work including detailed R & D analysis of the specifications for hydrogen bus deployment has been undertaken. This includes the EU funded 2015 Roland Berger- Hydrogen Fuel Cell Bus specification study and the 2016 EU project 'NewBusFuel' which analysed bus operator requirements for hydrogen re-fuelling infrastructure development research project.

In taking the detailed analysis to the next stage development towards implementation, a draft expression of interest (EOI) was submitted to Office for Low Emission Vehicles (OLEV) in October 2015 under the Low Emission Bus Scheme (LEBS). The Cabinet Member for Clean Streets, Recycling and the Environment supported the City Council in the joint submission with TfL, of the draft EOI, which showed that the cost of hydrogen buses estimated at £0.500m per bus.

The LEBS fund was structured to fund only £0.067m per bus towards the cost of proposed low emission buses, plus £1m towards the cost of the re-fuelling infrastructure, which is estimated at £5.442m and quoted in the detailed engineering studies based on Birmingham, as a project output of the NewBusFuel project, as mentioned in the previous paragraph. ITM Power have secured £4.442m funding sources through Innovate UK. The £1m OLEV funding will contribute towards the overall £5.442m for the electrolyser to produce the hydrogen, the compressor, storage and dispensing equipment to re-fuel the buses.

Although the LEBS scheme was not originally set up to provide funds to test the deployment of hydrogen buses, the draft EOI was accepted by the LEBS scheme given the potential of other funding being sourced through the European Union Hydrogen Fuel Cell Joint Undertaking (FCHJU), Local Growth Fund resources via Birmingham and Solihull Local Enterprise Partnership (GBSLEP) and the growing urgent need for 100% zero emission buses (as opposed to just low emission buses) to positively impact on air quality. At the time there was no formal commitment to fund. However, OLEV have since come back and approved the draft EOI as an R & D project. This explains why there was no executive report to approve a grant funding bid and why formal approval is now being sought for the

Clean Air Hydrogen Bus Pilot FBC.

With a focus on sourcing the funding required, a next step was to submit a application for FCHJU grant which was approved by the Assistant Director, Transportation and Connectivity. The application was for a grant contribution to the overall cost of the proposed 22 Hydrogen buses. The FCHJU grant offer contributes £185,490 towards the cost of each bus. The Council is a partner within this EU project, along with Transport for London and Aberdeen City Council and other European cities including Cologne, Brussels, Trento and Riga.

However, at the time of submission of the FCHJU application, the Council's role was set to support Travel West Midlands as the bus operator partner within the same FCHJU project. A revenue budget of £68,500 was approved by the Assistant Director, Transportation & Connectivity under Delegated Authority to fund officer time in support of this project. The former Travel West Midlands were awarded a capital grant of £4.0808m (£185,490 x 22 buses) from the FCHJU funded project

Approval for the Council to accept the £4.0808m (already approved for Travel West Midlands) and to take on the bus procurement role is now being requested following the realisation that Travel West Midlands, as a private sector company, would be in breach of state aid regulations if they were in receipt or benefit from the national funding (OLEV and potentially GBSLEP Local Growth resources) required to contribute towards the total cost of the buses. State Aid compliance is outlined further within Section 1 of this Full Business Case.

Travel West Midlands have since withdrawn from the FCHJU programme as a project partner. The FCHJU have been informed and confirmed the Council to take on this role. It is therefore proposed that the Council take on the role of procuring the buses and leasing them to a bus operator to address the state aid implications as described below under State Aid Compliance. The Council will therefore receive the OLEV funding of £1.474m in addition to the £4.081m from FCH JU and use this alongside the other funding sources to procure the buses.

The approach therefore has been one where the Council has collaborated with TfL and Aberdeen City Council, as part of a wider development to address economies of scale in securing commercial viability and to enable a deployment of 100 hydrogen buses by 2020. Initially Birmingham will have 22 buses (including 2 spare buses due to piloting refuelling), 20 for London and 20 for Aberdeen, within the first round of procurement, on the basis that 20 buses is the optimal number for running a bus route and the grant funding requires this number to ensure impact on emission reduction on the bus route. To ensure that this development is not just a pilot scheme, work will continue to develop towards establishing a city wide re-fuelling infrastructure with a commercially viable price for hydrogen and vehicles. Plans for deploying future hydrogen re-fuelling infrastructure, bus and other hydrogen vehicle models are being aligned with UK and EU funding sources and with other cities. This will ensure that the economies of scale continue to be developed will drive down costs making hydrogen vehicles and fuel are the zero emission choice of the future.

The CAHB Pilot is a 'first of a kind' in the UK and Europe, by producing hydrogen fuel for the proposed buses through electrolysing on site using new renewable energy from waste, based at Tyseley Energy Park, which is also set to be the first low/zero emission re-fuelling hub. The key aim of the CAHB Pilot in creating the economies of scale to significantly reduce costs in purchasing the hydrogen buses has led to significant work included detailed R & D analysis of the specifications for hydrogen bus deployment were undertaken including the EU funded 2015 Roland Berger- Hydrogen Fuel Cell Bus study and the 2016 EU NewBusFuel research project who examined the need for a commercialisation model for hydrogen buses, which the proposed CAHB Pilot addresses. TFL subsequently developed, and awarded a procurement framework for hydrogen buses. A mini competition will be run in January 2018 whereby the Council, TFL and Aberdeen City Council will jointly award the first contract. The Council will

order its own 22 buses under this contract.

Identifying the Bus route where the hydrogen buses will be deployed

The bus route in Birmingham will be determined once the Bus Operator is in place and the outcome of feasibility studies the Council are currently undertaking are known. This includes modelling air quality and traffic flows in line with the urgent need to meet compliance levels through emission reductions on specific city centre roads that significantly exceed the target levels for air quality, and where potentially the fleet of zero emission hydrogen buses will have immediate impact on emission levels to support compliance. The proposed 22 hydrogen buses will replace a whole fleet of diesel buses that operate on the identified route.

The CAHB pilot will be one of a series of supporting measures that address the need for clean air. Other measures which are being developed within the same timeline include parking restrictions, development of low/zero emission re-fuelling infrastructure, Liquid Petroleum Gas (LPG) retrofit technology development for fleets, including Black Cab Taxis, as part of a wider air quality programme.

The Council are collaborating with Transport for West Midlands (TFWM) and the Strategic Bus Alliance partnership. As such, the Low Emission Bus Strategy has been jointly developed. Both organisations support the CAHB Pilot and where issues may occur the Bus Services Act 2017 will afford TFWM more powers that will enable them to look at regulating standards for a particular corridor/route. Additionally, one of the Strategic Bus Alliance deliverables is to pilot zero emission buses on at least 2 corridors. TFWM with BCC are setting out to achieve this within the next 3 years. Through the CAHB pilot, this collaboration will support the further development of hydrogen bus and re-fuelling infrastructure deployment in future.

Financial Implications

The project will be funded from the resources as set out in the table below:

The CAHB Pilot sets out to procure and deploy up to 22 hydrogen buses at a total capital cost of £11m (£500k x 22 buses) with a contribution towards hydrogen refuelling infrastructure capital costs at £1m.

The total cost of the project is £13.440m. This is funded from OLEV grant (£3.814m), FCHJU grant (£4.141m) GBSLEP Local Growth Fund (£2.156m), Bus Operator contribution (£3.289m) and approved Future Council Programme resources of £0.040m. Grant conditions for the OLEV and FCHJU funding require the buses to operate for a minimum of 2 years with data analysis on impact of emissions reduction evaluated. This includes monitoring and data collection of mileage, operational costs and hydrogen fuel levels used. The Council will act as Accountable Body for the OLEV grant and the GBSLEP grant as it will be receiving the grant directly as project lead. This is not the case for the FCHJU grant as the Council's role is as one of the partner organisations.

The Accountable Body status requires the Council to have spent the funding by March 2019 ensuring value for money, and compliance with procurement and State Aid rules. There is no grant claw back after the project funding period which is 2021.

The Council have secured sufficient funding to cover all costs for the Council to procure the 22 buses and related infrastructure. This has been carried out in partnership with Transport for London (TfL), Aberdeen City Council and other EU city partners. The Birmingham funding package and expenditure for the Clean Air Hydrogen bus project is set out in the tables as below.

The Hydrogen Fuel Cell Joint Undertaking (FCHJU) is providing a capital grant of £4.081m towards the overall cost of procuring the hydrogen buses and a further £0.060m towards staffing costs to deliver the project.

The capital grant from OLEV for £2.474m, of which £1.474m will contribute

towards the cost of the Council of procuring up to 22 hydrogen Birmingham buses and £1m to be grant aided to ITM Power towards the overall cost for hydrogen re-fuelling infrastructure to be located at Tyseley Energy Park.

As Accountable Body for the OLEV grant, the £1m will be grant funded to ITM Power for hydrogen re-fuelling facilities subject to completion of a funding agreement. ITM Power are a partner of the wider hydrogen infrastructure development R & D project at Tyseley Energy Park which is separately funded through ITM Power. Passing the OLEV grant to ITM Power, as part of the overall R & D hydrogen bus and infrastructure development, will lever an additional £4.442m from ITM Power towards the overall cost of £5.442m for the hydrogen re-fuelling infrastructure required to re-fuel the buses.

Separate to the Birmingham arrangements to procure hydrogen buses, £1.340m of the OLEV grant as part of the overall funding of £3.814m, needs to be pass-ported to Transport for London, as a joint applicant and project partner under the OLEV grant scheme. They are set to fund their own procurement of hydrogen buses at the same time as the Council to enable the economies of scale of a larger order to bring the individual cost of each bus down.

An application to the GBSLEP for Local Growth Fund grant funding for the remaining costs of approximately £0.098m per bus towards the overall cost of £0.500m per bus has been made and although the independent financial appraisal has not been fully completed, it is anticipated that an offer letter will be received shortly.

Details of expenditure and funding sources to cover 22 hydrogen buses at £500k per bus.

Funding Source	Contribution Per Bus	Total Contribution (x22 Buses)
OLEV Low Emission Bus Funding	£67,000	£1,474,000
Horizon 2020 / Fuel Cell and Hydrogen Joint Undertaking (FCH JU)	£185,490	£4.080,800
Bus Operator lease cost contribution	£149,510	£3,289,200
GBSLEP Local Growth Fund (LGF)	£98,000	£2,156,000
Total	**£500,000**	**£11,000,000**

Ownership of the hydrogen buses will be with the City Council. However, until the Bus Operator is procured the City Council will not start procuring buses. The Bus Operator is set to be procured by December 2017, with the procurement of the hydrogen buses to commence by January 2018 with delivery by March 2019. It is proposed that the City Council will lease the buses to a procured bus operator project partner for a period of 7 years from March 2019, which aligns with the anticipated life of a hydrogen fuel cell engine. The Bus Operator will be required to pay their lease payment for the hydrogen buses on the same terms as the City Council is receiving from the bus supplier i.e. the first 20% at bus ordering stage in January 2018, 30% at mid-term manufacture stage and final 50% at final delivery of the hydrogen buses by March 2019. For accounting treatment, the lease with the Bus Operator will be classed as a finance lease on the basis that there is an expectation that a substantial amount of the economic life of the asset will be consumed by the end of the lease on the basis that hydrogen fuelled engines are innovative and it is envisaged that ownership of the asset will transfer to the bus operator at a peppercorn at the end of the lease.

The bus operator lease cost, is based on what a new Euro 6 diesel bus would cost, and will cover up to 7 years of operation, contributing towards the overall cost of the buses. The lessee will be responsible for all operational costs including hydrogen fuel, drivers, overnight storage and insurance. The Bus Operator will undertake to run the bus service for a minimum period of two years to comply with grant conditions. Servicing, maintenance and parts will be covered by the hydrogen bus manufacturer contract.

Taxation

The taxation consequences of the CAHB proposal have been reviewed and confirmed that there will not be any VAT cost implications for the Council, the bus operator or the fuel provider as all input VAT can be reclaimed on expenditure. The VAT cost implications considered include;

- The receipt of any grants by BCC will be outside of the scope of VAT.
- The purchase of the buses by BCC will be liable to VAT at 20%.
- The lease of the buses by BCC to the bus operator will also be liable to VAT at 20%.
- As BCC will charge VAT on the lease of the buses to the bus operator, BCC can reclaim VAT on the purchase of the buses.
- Passenger transport in a vehicle capable of carrying 10 or more passengers is zero rated. So, as zero is a rate of the bus operator can reclaim VAT on the lease of the buses as well as on its other running costs such as hydrogen fuel, maintenance and servicing.
- The development of the hydrogen re-fuelling facilities by ITM Power will be liable to VAT at 20%.
- The supply of hydrogen fuel will be liable to VAT at 20% so, ITM Power will be able to reclaim VAT on its development, operation and maintenance of the re-fuelling facilities.
- Any provision of land and property to ITM at Tyseley Energy Park ("TEP") will be an issue for ITM and the owner/landlord of TEP.
- The award of a grant by BCC to ITM (and any other parties) will be outside of the scope of VAT.

Investment leverage for economic growth

The proposed OLEV £1m grant funding to be passed via a grant agreement to ITM Power for hydrogen re-fuelling facilities, will lever an additional £4.442m from ITM Power towards the overall cost of £5.442m for the hydrogen re-fuelling infrastructure required to re-fuel the buses under the Clean Air Hydrogen Bus Pilot and connection to the renewable energy systems.

It is anticipated that current funding sourced at £8.844m from OLEV and FCHJU along with the GBSLEP Local Growth Fund resources, will lever further investments towards a £10m Training and Development Centre to be developed through the regional University partnership with the private sector to energise the renewable energy systems development called 'Energy Capital' to provide training and education programmes.

At least 20 apprentices a year will be trained in collaboration with Energy Capital partners, supply chain organisations in relation to the hydrogen market development and renewable energy systems, which include a maintenance garage for new fuel technology vehicles, specifically hydrogen buses. This will unlock additional investment of around £5m, providing the initial growth required to kick-start the Hydrogen market in Birmingham and transformation in employment and new business opportunities through the creation of new service and maintenance business opportunities attracting at least four new businesses to the re-fuelling hub at Tyseley Energy Park these include CNG Services, ITM Power, Argent Bio-Fuel distributers and Calor Gas.

Further business opportunities already identified will bring forward 20 jobs identified by Adelan, a hydrogen product development company and 15 jobs

through Micro-cabs, a hydrogen vehicle manufacturer.

Project Plan

The project plan is set out in Annex D and key milestones within Section 4, however the key measures that will determine whether this project is successful will be the deployment of a viable economic alternative to diesel fuel without the emissions. Additionally, project success will be the deployment of the hydrogen buses that will provide zero emission transport with the associated development of supply chains for the service, maintenance and re-fuelling.

Compliance with State Aid

The Council has taken external state aid advice from DWF, who are legal experts in the use of UK and EU funding for transport and renewable energy research and development, in relation to the proposed offer from the OLEV LEBS scheme, where capital funding is to used to fund the cost of the hydrogen buses and the re-fuelling equipment which will be operated by a private sector bus operator and hydrogen re-fuelling provider. The advice is that the CAHB Pilot does not contravene state aid rules, as it comes under the European Commission's R&D provisions of the General Block Exemption Regulation or "GBER". The project comes under the definition "experimental development" in Article 2 (86) of the GBER as the project will test the cost modelling and commercial viability of deploying hydrogen buses using renewable energy systems to create low cost electricity for the production of hydrogen as a zero emission fuel.

A clear distinction is being made between EU funding and National funding. The FCHJU European funding does not come under the State Aid requirements as it is an EU community fund which has already had sufficient 'Block Exemption' applied. National funding does fall under the State Aid regulations.

The focus of advice is therefore based on the OLEV LEBS and potentially the GBSLEP Local Growth Funding. State Aid is defined as giving commercial advantage or benefit to one commercial entity over another. Transparency of the process and actions taken as to how private and commercial companies are involved and benefitting from the project are key.

Normally a procurement process to select a provider or operator to deliver a service or product would satisfy the State Aid requirements. However, the Clean Air Hydrogen Bus Pilot has a level of complexity as a result of the number of grants (from national and EU funding sources) that need to be applied concurrently. This includes; the Council procuring and owning the buses; a Bus Operator as a Development Partner that will also lease the buses from the Council; bus operator benefitting from the various grants that will have contributed to the majority of the cost of the hydrogen buses; the bus operator set to operate the buses as a commercial entity.

The CAHB Pilot assessment by DWF that the pilot fits within the European Commission's R&D provisions of the General Block Exemption Regulation or "GBER". The "experimental development" in Article 2 (86) of the a GBER as the project will test the price modelling and commercial viability of deploying hydrogen buses using renewable energy systems to create low cost electric for the production of hydrogen as a zero emission fuel technology.

More specifically;

- Testing the scope and scale of the renewable energy systems required to create low cost electricity and produce on-site low cost hydrogen to refuel a fleet of at least 22 hydrogen double deck buses that operate a normal bus route service on roads that currently exceed air quality levels.
- Testing the commercial viability and fuel pricing model using renewable energy for hydrogen production for fuelling double deck hydrogen buses - only single deck hydrogen buses have been deployed to date, and where operational in the UK are currently subsidised thorough transport/local authorities and fuelled by hydrogen delivered by tanker from Europe.

The external state aid advice also confirmed that;

- The project should procure a Bus Operator to lease the buses from the Council.

The Council should proceed with using the Transport for London procurement framework for hydrogen buses, and jointly with Transport for London and Aberdeen City Council, to appoint the Bus Manufacturer to build and provide the buses with payment through the procured commercial contract arrangements with the Council paying invoices.

The advice aligns with the State Aid approach of an R & D pilot scheme, where a bus operator partner is sought to operationally test the commercial viability of the hydrogen buses and fuel. The bus operator will lease the buses paying what they would have done for 22 new diesel buses, thus contributing £3.289m towards the funding package to cover the overall capital cost of the hydrogen buses. The buses will be procured using the Transport for London hydrogen bus framework. In regard to the hydrogen fuel provider, ITM Power, passing the OLEV LEBS grant element of £1m for hydrogen infrastructure through a grant agreement, in order to lever in the required £4.442m to cover the overall cost of the hydrogen re-fuelling infrastructure. The advice from the external state aid advisors confirms that this does not contravene state aid. ITM Power have been collaborating with the R & D development throughout the project development given they were the only UK hydrogen company at the time, and are providing the majority of secured funding for the hydrogen infrastructure.

In regard to ITM Power, as the hydrogen provider, they have been collaborating with the R & D development by providing the majority of funding themselves for the hydrogen infrastructure as a key part of the overall pilot project. The Council will need to pass the Office of Low Emission Vehicle 'Low Emission Bus Scheme' maximum funding of £1m for hydrogen infrastructure through a grant agreement to ITM Power, in order to lever in the required £4.442m to cover the overall cost of the hydrogen production and re-fuelling equipment.

ITM Power, as a private sector hydrogen provider, have worked alongside TEP and the Council in the design and delivery of hydrogen infrastructure appropriate for re-fuelling buses to meet the same operational requirements as for diesel buses. ITM Power are set to deploy funding they have secured through Innovate UK for which they have already signed contracts for and also to invest their resources in locating the hydrogen re-fuelling infrastructure and make their own arrangements with TEP to lease the site required. The £1.0m grant to be passed to ITM under grant agreement will contractually require ITM Power to provide the facilities that utilise lower cost renewable electricity produced at TEP within the hydrogen production process (electrolysing electricity and water), and for it to be compressed, stored and dispensed to the buses.

As part of the R & D nature of the pilot, ITM Power are providing the hydrogen production infrastructure, where the CAHB pilot is set to develop the price modelling for commercially viable hydrogen fuel as a result of the renewable energy systems aligning with the hydrogen production process and producing hydrogen at scale to run the bus fleet.

Mitigation of risk will be managed by a phased development and testing of the energy systems as they get connected as part of a robust project management process. The hydrogen infrastructure will be developed over the first year from January 2018 ahead of the buses being delivered in March 2019. The hydrogen plant will be tested in 1 mega-watt 'stack' developments up to 3 mega-watts, which is required for 22 buses. This will ensure everything works before the buses are delivered and operationally tested.

Procurement Strategy

The procurement strategy and process for selecting the Bus Operator and the Hydrogen Bus Manufacturer is detailed in Annex A.

Compliance with the BBC4SR is a mandatory requirement that will form part of the conditions of contract. However, it is anticipated that may only apply in full to the bus operator contract as the bus manufacturer contract will be through the TfL framework, where the council are not in a position to mandate it. Tenderers will submit an action plan with their tender that will be evaluated in accordance with the procurement strategy and the action plan of the successful tenderer will be implemented and monitored during the contract period.

Procurement Approach - **Bus Operator**

Duration and Advertising Route - The proposed duration of the contract will be for a period of 7 years.

The tender opportunity will be advertised via Contracts Finder, Find It In Birmingham, and the Official Journal of the European Union (OJEU).

Procurement Route for Bus Operator - To enable the successful delivery of the project, a procurement exercise will be undertaken, using the open tender route and where the operator's contribution will be part of the tender process, the details of which are contained within Annex B accompanying this report.

Cabinet approval to strategy	24th October 2017
OJEU notice issued	1st November 2017
Clarification period	1st November – 29th November 2017
Tender return date	4th December 2017
Tender evaluation	5th December – 8th December 2017
Delegated contract award	11th December – 22nd December 2017
Contract Start	16th January 2018

Procurement Route – **Bus Manufacturer**

To enable the successful delivery of the project, a procurement exercise using a mini competition will be undertaken to select a hydrogen bus manufacturer using the Transport for London Framework Agreement for Hydrogen Fuel Cell Buses, the details of which are contained within Annex A accompanying this report

Invitation to Tender Issued	1st February 2018
Clarification period	1st– 28th February 2018
Tender return date	2nd March 2018
Tender evaluation	5th – 9th March 2018
Award report	12th – 23rd March 2018
Contract Start	26th March 2018

*Links to Corporate and Service Outcomes

Birmingham City Council's Priorities

This project supports the following Vision and Forward Plan 2017+ priorities:

- **Job & Skills**
  Build upon our assets, talents and capacity for enterprise and innovation to shape the market and harness opportunity.
- **Health**
  Help people become healthier and more independent with measurable improvement in physical activity and mental wellbeing.

Birmingham Development Plan

The overall vision of the BDP is to establish Birmingham as an enterprising, innovative and green city that has delivered sustainable growth meeting the needs of its population and strengthening its global competitiveness.

This project is linked to the following objectives from the Birmingham Development Plan:

- To create a more sustainable city that minimises its carbon footprint and waste while allowing the City to grow.
- To ensure that the city has the infrastructure in place to support its future growth and prosperity.

Birmingham Connected

This project is linked to the following core objectives:

Efficient Birmingham

- Birmingham Connected will facilitate the city's growth agenda in the most efficient and sustainable way possible, strengthening its economy and boosting jobs with key priorities around;
    - Efficient and sustainable movement of people.
    - Efficient and sustainable movement of goods.

Sustainable Birmingham

- Birmingham Connected will specifically reduce the impacts of air and noise pollution, greenhouse gas emissions and energy consumption, with a key priority of;
    - Reduced greenhouse gas emissions from transport.

Healthy Birmingham

- Birmingham Connected will contribute to a general raising of health standards across the city through the promotion of walking and cycling and the reduction of air pollution.

West Midlands Combined Authority Strategic Economic Plan

This project is linked to the following SMART objectives:

Environment

- Improved competitiveness through energy and resource efficiency, stimulating new technology and business, with a key priority of;
    - Carbon dioxide (CO2) produced from direct emissions by transport, businesses and housing based on 2010 baseline being 40% less.

Greater Birmingham and Solihull Strategic Economic Plan

This project is linked to the strategic pillar of 'Place' and the key enabler of 'Optimising physical, cultural and environmental assets'.

Transport for West Midlands, Movement for Growth

The project is linked to key objectives of:

Environment

- To significantly improve the quality of the local environment in the West Midlands Metropolitan Area.
- To help tackle climate change by ensuring large decreases in greenhouse gas emissions from the West Midlands Metropolitan Area.

Public Health

- To assist with the reduction of health inequalities in the West Midlands Metropolitan Area

Project Definition Document	N/A	**Date of Approval**	N/A

Approved by			
Benefits Quantification - Impact on Outcomes	**Measure**	**Impact**	
	Up to 22 hydrogen buses procured and deployed.	• Hydrogen bus fleet replacing current diesel fleet that operates on specific air quality hotspot. Reduction in emissions to meet air quality compliance by 2020.	
	Renewable energy systems developed to produce zero emission hydrogen transport fuel	• Air quality improvements supporting the Council to meet air quality compliance by 2020. • Enable key stakeholders including local residents, people who work in or visit Birmingham having better health & well-being from clean air. • The Council and Greater Birmingham & Solihull Local Enterprise Partnership (GBSLEP) will realise the acceleration of growth of low carbon and environmental technologies.	
	Unlock economies of scale to enable a faster route to commercialisation of zero emission bus transport	• Renewable electricity produced at scale and at minimum cost. • A tested model that ascertains the level for commercially viable hydrogen as a transport fuel for buses. • Should enable more buses to be procured at lower costs and operated within the city.	
	Catalyst for growth – creating jobs	• New growth sector providing structural development from private sector investment opportunities; Supply Chain development opportunities; Higher Education development of programmes; overall impact on employment, skills training and apprenticeship opportunities. • Local residents of the Eastern Corridor regeneration area of the city, including Yardley Wood, Tyseley, Nechells, Small Heath and Acocks Green access to new job and training opportunities in the alternative low/zero emission fuel and renewable energy sector.	
	Applying innovative Birmingham based renewable energy technology as a public transport zero emission fuel	• Lessons learned and business case development for further renewable energy and hydrogen bus deployment. • The Council providing leadership in establishing the infrastructure for a Future City agenda as well as improving air quality in line with the Clean Air Zone and meeting compliance.	
Project Deliverables	• Private Bus Operator procured and in collaboration with the Council, will inform the Birmingham hydrogen bus specification. • Hydrogen bus manufacturer procured with an order for up to 22 hydrogen buses being placed.		

	• Hydrogen infrastructure aligned with renewable energy systems. • Up to 22 hydrogen buses deployed on agreed route(s). • A price model developed for the use of renewable energy in hydrogen production as a commercially viable fuel.
Scope	The scope considered in this business case includes the use of national and EU funding sought to procure up to 22 hydrogen buses; the Council having ownership; leasing the buses to the procured Bus Operator to run on agreed route (s); assessment of the commercial viability of using renewable energy systems for hydrogen as a transport fuel for buses.
Scope exclusions	The project is to provide up to 22 hydrogen buses for a procured bus operator, the City Council is not liable for running costs, repairs and hydrogen fuel cell replacement. The grant to ITM power to facilitate hydrogen power assumes an electrolysing process based upon recycling wood bio mass, if this is not sufficient then ITM power are responsible for generating sufficient hydrogen to fuel the buses
Dependencies on other projects or activities	• The low and zero emission fuel hub at Tyseley Energy Park set to be operational by September 2018. • Formal approval of £2.166m grant from the GBSLEP. • Grant/funding agreements • Appointment of Bus Operator/Bus supplier • Selection of bus routes to operate on
Achievability	• The Council has been working in collaboration with Transport for London and Aberdeen City Council, who already have experience and capability from delivering the first generation of hydrogen bus demonstrators, to enable a co-ordinated and scaled up deployment of fuel cell buses and hydrogen refuelling infrastructure. The Council is further supported through the UK hydrogen cluster co-ordinators, who are the project managers and project lead partner of the FCHJU funded programme that is set to enable affordable hydrogen buses by grouping UK cities to jointly procure large numbers of fuel cell buses and unlock economies of scale. Getting to commercial viability where the cost of hydrogen buses is more affordable is a key priority, and is further supported by working with other UK cities such as London and Aberdeen, meaning that the CAHB Pilot will build on experience that is already in place and provide a baseline understanding from which Birmingham can establish commercialisation more quickly. Using local renewable energy, the Council will also ensure zero emissions and the lowest energy costs, aiding the commercial viability of hydrogen fuel costs as well. • Detailed feasibility assessments within Birmingham were undertaken during Spring / Summer 2015 in collaboration with Transport for London and Aberdeen City Council. This led to securing grant funding base specification for the hydrogen buses and re-fuelling infrastructure and the development of a procurement framework. • Significant work has been undertaken as part of the collaboration led by Transport for London and with Aberdeen City Council, to develop a National Procurement Framework for hydrogen buses. Bus operators, hydrogen providers and bus manufacturers have been engaged and consulted with as part of this market development project. • The Council already has a key relationship with Tyseley Energy Park, as part of the Birmingham Development Plan for the Tyseley Environmental District and the Eastern Corridor regeneration plans. Tyseley Energy Park received full planning permission November 2016 to deliver a range of low and zero emission fuels including hydrogen production and dispensing, alongside compressed natural gas/CNG, electric charging, Liquefied Petroleum

	Gas/LPG and Bio-diesel. It is set to be operational from September 2018 and forms part of the wider Clean Air Zone additional measures required to assist the transition of public and private sector fleets towards zero emissions to dramatically improve air quality.		
Project Manager	Sylvia Broadley – Air Quality Manager – Transportation & Connectivity, Economy. Tel: 07730 282091 E-mail: sylvia.broadley@birmingham.gov.uk		
Budget Holder	Simon Garrad – Head of Delivery– Transportation & Connectivity, Economy. Tel: 0121 303 7409 Email: simon.garrad@birmingham.gov.uk		
Sponsor	Phil Edwards – Assistant Director – Transportation and Connectivity, Economy. Tel: 0121 303 6467 E-mail: philip.edwards@birmingham.gov.uk		
Project Accountant	Rob Pace – Finance Manager Tel: 0121 303 7107 E-mail: rob.pace@birmingham.gov.uk		
Project Board Members	A Project Board will be set up to oversee delivery of the project. This will include representatives for the successful consortia. The project board will include: Project Sponsor – Phil Edwards Project Users – Simon Garrad Project Supplier – To be determined through tender Additional support to be provided by Sylvia Broadley (Air Quality Manager)		
Head of City Finance (HoCF)	Simon Ansell	**Date of HoCF Approval:**	12/10/2017

3. Budget Summary

	2017/18	2018/19	Totals
	£000s	£000s	£000s
Hydrogen Buses:			
Capital Costs and Funding			
City Council - 22 buses x £0.5m	2,200,000	8,800,000	11,000,000
Contribution to Transport For London for Procurement of buses	1,340,000	0	1,340,000
Hydrogen Infrastructure			
Contribution towards Hydrogen Compressor, Storage & Dispenser	1,000,000	0	1,000,000
Total	**4,540,000**	**8,800,000**	**13,340,000**
Funding			
OLEV	562,800	2,251,200	2,814,000
FCHJU	1,888,160	2,192,640	4,080,800
GBSLEP	431,200	1,724,800	2,156,000
Bus Operator lease cost	657,840	,2,631,360	3,289,200
Total	**3,540,000**	**8,800,000**	**12,340,000**
Hydrogen Infrastructure			
OLEV	1,000,000	0	1,000,000
Total	**4,540,000**	**8,800,000**	**13,340,000**
Revenue Costs and Funding			
Expenditure			
Development costs to proceed to Full Business Case	10	0	10
Staff project management resources	45	45	90
Total	**55**	**45**	**100**
Funding			
Future Council Programme – SN2 – Clean Air Zone	25	15	40
FCHJU staff revenue costs	30	30	60
Total	**55**	**45**	**100**

4. Milestone Dates

Key Project Milestones	Planned Delivery Dates
Bus operator procured	16th January 2018
Hydrogen bus manufacturer procured with order for up to 22 hydrogen buses placed.	26th March 2018
Hydrogen buses delivered	March 2019
Hydrogen infrastructure connected with renewable energy systems to draw on renewable electricity in the production of hydrogen.	September 2018
Hydrogen buses deployed on agreed route.	June 2019

Remaining key milestones for this project have been assessed and are listed in table 1 below:

Table1: Key Milestones

Milestone	Target Date
Approval of FBC and Procurement Strategy.	24th October 2017
Procurement of bus operator	16th January 2018
Procurement of Bus Manufacturer	26th March 2018
Hydrogen Refuelling Infrastructure (HRI)	
Site preparation completed for Tyseley Energy Park re-fuelling hub development.	October 2017
Tyseley Energy Park detailed HRI design sign-off	September 2017
Hydrogen production and re-fuelling equipment installed	April 2018
Private wire/ renewable electricity connection secured	June 2018
Commissioning & Testing complete	September 2018
Renewable energy system hydrogen production & storage start	October 2018
Hydrogen Bus Development and Deployment	
Hydrogen bus base specification finalised	December 2017
Bus suppliers procured maintenance, parts & servicing contracts signed off.	January 2018
Hydrogen Buses delivered to Birmingham	March 2019
Personnel training on HRI and bus operation training complete	May 2019
Maintenance regime established	May 2019
Clean Air Zone Hydrogen Bus route air quality impact assessment evaluation completed.	December 2020

5. Checklist of Attachments included in the FBC:		
Item	**Mandatory attachment?**	**Number attached**
Financial Case and Plan:		
Detailed Workings in support of budget implications	Mandatory	Included in Section 1
Statement of required resource (people, equipment, accommodation) – append a spreadsheet or other document	N/A	N/A
Project Development products:		
Milestone Dates and Timing Plan	Mandatory	Included in Section 4 and ANNEX D
Risk Management Assessment	Mandatory	Included in ANNEX C
Stakeholder Analysis		Included in ANNEX E
Other Attachments (list)		
Summary of key policy relating to the need for Clean Air Hydrogen Bus Pilot	Non-mandatory	Included in ANNEX B

ANNEX A – Clean Air Hydrogen Bus Pilot Procurement Strategy
ANNEX B – Summary of key policy relating to deployment of Clean Air Hydrogen Bus pilot
ANNEX C – Risk Register
ANNEX D – H22 Project Plan
ANNEX E – Stakeholder Analysis

ANNEX A - Procurement Strategy

The procurement for the Hydrogen buses will take place in two stages. The first will be focused on the procurement of a Bus Operator, and the second a Bus Manufacturer.

1. Bus Operator

1.1. There are currently 31[2] bus operators providing transport services within the West Midlands area, with the majority of routes in Birmingham managed by National Express. None of the current service providers use Hydrogen Buses, this will be a new service for Birmingham and one of the first large scale hydrogen bus deployments in the UK to study the effects on air quality.

1.2. Scope and Specification

1.3. The Bus Operator will be required to;

1.3.1. Provide expert advice and assistance with the drafting of a specification for the Hydrogen Buses that meets the Birmingham market, specifically the final 'fit-out' of the buses. The technical base specification for hydrogen buses will be defined during the Framework Call-Off (see point 2.2 below).

1.3.2. Propose a strategy for the implementation of an effective commercial Hydrogen Bus service on identified routes (A38, A45, City Centre) that currently exceed air quality limits.

1.3.3. Lease the buses from the Council and meet the operational revenue and resources to operate the Hydrogen Buses without additional funding from the Council.

1.3.4. Manage and operate the Hydrogen Bus routes, including all staffing, training and back-office functions.

1.3.5. Collect weekly data on the effectiveness, reliability and commerciality of the service.

1.3.6. Along with the Council enter into an agreement with the Hydrogen Bus Manufacturer to cover all liabilities for the maintenance, servicing, availability of parts and training of staff in regard to the Hydrogen Buses.

1.3.6.1. For the avoidance of doubt, the Bus Operator will take on-board all liabilities for the maintenance, servicing and training of staff.

1.3.6.2. However as the call-off process for the Bus Manufacturer needs to be conducted by the Council, the call-off agreement will be in the Councils name.

1.3.6.3. A separate agreement between the Bus Operator and Bus Manufacturer will be required as the Council will not be involved in the day to day maintenance of the Hydrogen fleet.

1.4. Contract Duration & Advertising Route

1.4.1. The contract period will be 7 years. This has been based on a standard 7 year life span for buses hydrogen fuel cell engine.

1.4.2. The contract opportunity will be advertised in OJEU, Contracts Finder and Find It In Birmingham.

[2] https://journeyplanner.networkwestmidlands.com/operator

1.5. Evaluation and Selection Criteria

1.5.1. A full detailed tender and selection process will be carried out in accordance with Birmingham City Council's procurement governance arrangements (PGA) and obligations to find an organisation that meets the above requirements.

1.5.2. The evaluation and selection process will be split into 4 stages as follows:

Stage 1 – Selection Stage (Pass/Fail)

- Company Information for Birmingham based operation, operating specified routes with a minimum fleet of 20 buses, that supports depot and maintenance suitable for hydrogen buses.
- Grounds for Mandatory Exclusion
- Grounds for Discretionary Exclusion
- Economic and Financial Standing
- Technical and Professional Ability
- Additional Selection Questions
    - Environmental Management
    - Insurances
    - Compliance to Equalities Duties
    - Health & Safety
    - Compliance to the Birmingham Business Charter for Social Responsibility

Tenderers must satisfactorily complete Stage 1 to progress to Stage 2.

Stage 2 – Quality (60% weighting)

Sub-Criteria	**Sub-Weighting**
Data Security	**Pass/Fail**
Engineering quality management and service reliability	25%
Implementation Plan	25%
Customer Care & Support	20%
Marketing & Promotion	10%
Business Intelligence & Management Information	20%
TOTAL	**100%**

Tenderers who score less than 60% of the quality threshold i.e. a score of 300 out of a maximum quality score of 500 may be excluded from taking any further part in the process.

Stage 3 – Social Value (20% weighting)

Sub-Criteria	Sub-Weighting
Local Employment	20%
Partners in Communities	20%
Good Employer	10%
Low/zero emission technology upskilling and apprenticeships	40%
Ethical Procurement	10%
TOTAL	**100%**

Suppliers will be asked to provide an action plan which will show the commitments they intend to make to help achieve the Social Value outcomes of this project. This may include, for example; upskilling the local workforce to be able to maintain and repair hydrogen buses, providing apprenticeships, plans to reduce pollution, or working with local business to promote hydrogen technology. The action plan will specifically ask for actions which will be taken outside of those required to provide the service.

Tenderers who score less than 40% of the social value threshold i.e. a score of 200 out of a maximum social value score of 500 may be excluded from taking any further part in the process.

Stage 4 – Financial contribution (20% weighting)

Sub-Criteria	Sub-Weighting
Cost (Lease contribution with a set minimum amount)	100%
TOTAL	**100%**

Overall Evaluation

The evaluation process will result in comparative quality, social value and price scores for each tenderer. The maximum quality score will be awarded to the bid that demonstrates the highest quality. The maximum social value score will be awarded to the bid that demonstrates the highest social value. The maximum price score will be awarded to the lowest acceptable price. Other tenders will be scored in proportion to the maximum scores.

Evaluation Team

The evaluation of the tenders will be undertaken by officers from Transportation & Connectivity and UK Hydrogen Cluster Co-Ordinators, Element Energy. The team will be supported by the Assistant Procurement Manager of Corporate Procurement Services and City Finance.

Implementation Plan (Indicative TBC)

Task	End date
Cabinet approval to strategy	24th October 2017
OJEU notice issued	1st November 2017
Clarification period	1st November – 29th November 2017
Tender return date	4th December 2017
Tender evaluation	5th December – 8th December 2017
Delegated contract award	11th December – 22nd December 2017
Standstill	3rd January – 15th January 2018
Contract Start	16th January 2018

Service Delivery Management

The contract will be managed operationally by the Assistant Director for Transportation & Connectivity (who may delegate this task to a member of their team) and commercially by the Contract Manager, Contract Management Team, Corporate Procurement Services.

2. Purchase of Hydrogen Buses

2.1. Transport for London (TfL) has tendered a Framework Agreement for the manufacturing and supply of Hydrogen Buses. This Framework Agreement has been developed with input from Aberdeen City Council and Birmingham City Council (Air Quality Manager. Two Bus Manufacturers have been selected to be on the framework.

2.2. The Contract Notice containing details of the TfL framework can be found here; http://ted.europa.eu/udl?uri=TED:NOTICE:157506-2017:TEXT:EN:HTML&src=0

2.3. TFL, Birmingham City Council, and Aberdeen City Council will jointly run a further Competition using the TfL Framework Agreement to source the Hydrogen Bus manufacturer to enable one order for a total number of base specification hydrogen buses to be placed to benefit from economies of scale to achieve lower cost per bus. The Further Competition will be led by TfL.

2.4. The Council will be responsible for placing the order, and paying for the 22 hydrogen buses it requires with the Hydrogen Bus Manufacturer and then leasing the buses to the Bus Operator. The Council will retain ownership over the Hydrogen Buses for the length of the contract.

2.5. The Bus Operator and Hydrogen Bus Manufacturer will be required to enter into a contractual agreement for the maintenance and servicing of the Hydrogen Buses for the length of the contract.

2.6. Scope and Specification

The Hydrogen Bus Manufacturer will be required to;

2.6.1. Produce a technical design which meets the internal fit out requirements defined by the Council and the Bus Operator.

2.6.2. Outline the maintenance, servicing and parts support offered along with warranty periods.

2.6.3. Outline training requirements for servicing, maintenance and operations.

2.7. Contract Duration & Advertisement Route

2.7.1. The contract period will be 7 years. This has been based on a standard 7 year life span for hydrogen bus engine technology.

2.7.2. The tender opportunity will be advertised to the suppliers awarded to the TfL Framework Agreement.

2.8. Evaluation and Selection Criteria

2.8.1. A full detailed Further Competition process will be carried out by TfL, with input from Birmingham City Council and Aberdeen City Council, in line with the Public Contracts Regulations 2015 and procurement best practice to select a single manufacturer for hydrogen buses.

2.8.2. The evaluation and selection process will follow the process stipulated by the TfL Framework Agreement.

2.8.3. The evaluation criteria for the Call-Off process will be drawn up between the technical and procurement representatives of TfL, Birmingham City Council and Aberdeen City Council. The Price/Quality/Social Value split is not currently available as this will be agreed between the above participants through the Call-Off process which will be led by TfL.

2.9. Social Value

2.9.1. Suppliers will need to pass TfL's Social Value checklist in order to be appointed to the Framework Agreement. In accordance with the protocol of the framework agreement, social value will not be an evaluation criterion. However, the successful supplier will be requested to voluntarily sign up to the Birmingham Business Charter for Social Responsibility and provide action proportionate to the nature of the contract.

Overall Evaluation

The evaluation process will be conducted jointly with TFL, Birmingham City Council, and Aberdeen City Council. Each tenderer will have their quality, social value and price scored against the framework criteria. The maximum quality score will be awarded to the bid that demonstrates the highest quality. The maximum social value score will be awarded to the bid that demonstrates the highest social value. The maximum price score will be awarded to the lowest acceptable price. Other tenders will be scored in proportion to the maximum scores.

Evaluation Team

The evaluation of the tenders will be undertaken by officers from Transportation & Connectivity, UK Hydrogen Cluster Co-ordinators, Element Energy, and procurement officers from Aberdeen City Council. The team will be supported by the Assistant Procurement Manager of Corporate Procurement Services.

Implementation Plan (Indicative TBC)

Task	**Date**
Invitation to Tender Issued	1st February 2018
Clarification period	1st– 28th February 2018
Tender return date	2nd March 2018
Tender evaluation	5th – 9th March 2018
Award report	12th – 23rd March 2018
Contract Start	26th March 2018

Service Delivery Management

The contract will be managed operationally by the Air Quality Manager, Transportation & Connectivity and commercially by the Contract Manager, Contract Management Team, Corporate Procurement Services.

ANNEX B – Summary of key policy relating to the use of renewable energy electric in the production of hydrogen as a zero emission transport fuel for buses.

Birmingham Development Plan and Birmingham Connected

Future demand for travel into the city centre is forecast to increase, not only in the context of major developments such as the Enterprise Zone and HS2, but the city's expanding population and significant housing growth. By 2031 work undertaken as part of the Birmingham Connected transport strategy (which considers land use changes proposed in the Birmingham Development Plan) forecasts 150,000 new residents, 80,000 more cars on the roads and 200,000 extra daily trips. Circa 4 million daily trips are expected across the city by 2031, an increase of 30% from today's levels.

The Birmingham Development Plan includes a low emission vehicles policy (TP42) for city connectivity. Accordingly proposals for Low Emission Vehicles will be underpinned by a range of measures that the city council supports in the provision of adequate and appropriate infrastructure.

Birmingham's Clean Air Zone

Birmingham City Council is set to be mandated by Government to implement a Clean Air Zone so as to achieve compliance with UK and EU air quality legislation in the shortest possible time. In order for the CAZ to be a success, it is accepted that two effects need to be seen:

- A reduction of vehicles on the road (as a result of people making smarter, more sustainable decisions over the way they travel)
- An increase in the proportion of cleaner vehicles on the road with the associated level of low/zero emission re-fuelling infrastructure.

Carbon Roadmap and Blue Print for Low Carbon Fuel Refuelling Infrastructure

In 2013, the Birmingham Green Commission published the Carbon Roadmap which is a strategic plan that highlights the key initiatives that Birmingham will aim to complete to ensure:

- the city achieves its vision of becoming a leading green city
- a reduction in carbon dioxide emissions by 60 per cent by 2027 (when compared to 1990 baseline levels)

The Carbon Roadmap highlighted that transport emissions account for 23% of Birmingham's CO_2 emissions and therefore is a key area for improvement.

Supporting the fleet share of low emission vehicles and encouraging adoption of green fleets is a key component of the approach for improving the carbon footprint of transport in the city.

The Birmingham 'Blue Print' strategy for Low Carbon Fuel Refuelling Infrastructure was published in 2015. This report outlined a route forward for developing the city's low carbon fuel refuelling infrastructure. The report made specific recommendations on the best way forward to develop the hydrogen infrastructure and transition of fleets, particularly buses. There are a series of points from this document that are of relevance for this business case such as the strategic locations for re-fuelling stations within the city and proximity to the key route and motorway network and fuelling technologies that provide significant impact on emission reduction.

ANNEX C – RISK REGISTER

	Risk Identification *(inherent assessment)*						**Risk Mitigation** *(residual risk)*						
Ref	**Risk**	**C = Cause E = Effect**	**Proximity**	**Probability**	**Impact**	**Overall Score**	**Counter Measures - Underway and / or Planned**	**Probability**	**Impact**	**Overall Score**	**Action Date**	**Current Status**	**Risk Owner**
000	*e.g. project delay; increased cost; decreased functionality or benefits*	**C:** *e.g. unforeseen ground conditions; tender quotes higher than expected; delays experienced with dependency project* **E**: *e.g. programme slippage*	*Short / Medium / Long*				*Brief description of what is being done to address the risk e.g. do you intend to transfer the risk (and how) or treat the risk (and how), etc.*				*When the counter measures will be in place e.g. contract signing with contractor.*	*Static / Active*	
001	Lack of suppliers of hydrogen buses	**C:** Hydrogen buses are not in main stream production and currently double deck hydrogen buses are not available on the market **E:** Potentially choice limited to single deck buses	Short	1	1	1	Recent discussion with bus manufacturers show a confidence in manufacturing hydrogen buses and meeting the timescales for delivery and within budgeted costs. Two manufacturers identified and secured on a framework contract who can provide double decker buses. Mini competition to provide value for money	1	1	1	01/09/17	Static	Sylvia Broadley- Funding Management Co-ordination
002	Cost escalation on the infrastructure side for hydrogen bus refuelling.	**C:** As a result of early hydrogen market development and it's pre-commercialisation **E:**Delay in infrastructure deployment whilst additional funding is sought to challenge cost escalation.	Short	2	2	4	Costs have been worked up in collaboration with hydrogen providers. Funding has already been secured to cover the infrastructure. Ultimately if costs escalate we have the option of a 'delivered' model for hydrogen as opposed to hydrogen production on site, which has a higher capital cost. Funding requested covers the cost of new buses only. Option to run buses on delivered hydrogen until production site can be generated on a value for money basis.	2	2	4	01/03/18	Static	Bus Operator
3	The delivery programme cannot be aligned to the funding deadlines.	C: To cover the cost of hden buses a number of funding sources have been secured E: With each funding source with different deadlines will impact depedency of when funding allocatons to procure hydrogen buses is made available.	Medium	2	4	8	Procurement framework, bus ordering and bus delivery has been aligned with current knowledge of funding deadllines. Delivery options to be reviewed, LEP to be kept updated on project progress and early warning to be given if funding spend deadlines are unlikely to be achieved. Funding has been secured as follows:- OLEV - £1,474k Original document 2/04/16 Horizon - £4,080.8k Letter of confirmation dated 19/01/17 National Express - £3,289.k Letter of confirmation dated 28/11/2016 Above funding sources as per proposed cashflow	2	4	8	01/06/17	Active	Sylvia Broadley- Funding Management Co-ordination
4	Delivering the overall programme of hydrogen FC bus deployment and operation involves the	C: Delay in deployment of TEP access road.	Short	2	5	10	Planning permission for the refuelling infrastructure at TEP has been granted. Private funding of £1.350m for the development of the new access road in to TEP has been secured. Now awaiting the GBSLEP gap funding of	2	5	10	01/05/17	Active	Sylvia Broadley- H2 Bus Programme Management Co-ordination

	Risk Identification *(inherent assessment)*						**Risk Mitigation** *(residual risk)*						
Ref	**Risk**	**C = Cause E = Effect**	**Proximity**	**Probability**	**Impact**	**Overall Score**	**Counter Measures - Underway and / or Planned**	**Probability**	**Impact**	**Overall Score**	**Action Date**	**Current Status**	**Risk Owner**
	installation of the refuelling infrastructure at Tyseley Energy Park (TEP).	E: Delay to installation in hydrogen refuelling infrastructure and delay in deployment of hydrogen buses					£1.253m to proceed with developments. The road implementation is not dependant on any other fundng sources or other developments. The £1.253m has been agreed in principle by the LEP awaiting final confirmation						Rachael Smith- ITM Power Hydrogen Infrastructure
5	Unforeseen technical issues for renewable electric supply set to be connected to hydrogen production refuelling infrastructure at TEP.	C. Delay to development of renewable electricity supply E. Additional costs on mains alternative connection to National Grid electric supply. Also impacted on Kilowatt cost and impacts on price modelling.	Short	2	5	10	Ongoing dialogue with renewable energy suppliers / land owner and ITM Power. Connection Plans have been drawn up and agreed. Short term solution identified in risk 2 of delivery model to supply hydrogen	1	5	5	09/08/2017	Active	David Horsfall- Tyseley Energy Park Sylvia Broadley - Programme Management
6	Hydrogen Plant not being commissioned to use by the date of bus mobilistion	C. Correct infrastructure not being in installed and tested at TEP in time. E. Additional costs to keep the buses in storage, time delay on bus mobilisation and use of the hydrogen plant.	Medium	2	5	10	Ongoing communication between TEP and ITM power to ensure infrastructure compentents are being manufactured to the required specification and are following the key dates for completion and delivery. Due for completion on September 2018 Short term solution identified in risk 2 of delivery model to supply hydrogen	2	4	8		Active	Rachael Smith- ITM Power Hydrogen Infrastructure Sylvia Broadley BCC Programme Management
7	Lack of maintenance facilities and trained staff to maintain the fleet	C. New and current staff from the bus operator not receiving sufficient training on the new buses and the correct facilities not being in place to store and maintain the bus fleet. E. The buses are poorly maintained leading to a possible increase in technical faults whilst on operations. Outcomes therefore not achieved	Medium	3	4	12	Mini competition for supplier to deal with key issues:- * Spares in country * Tender deal with maintenace of buses * Tender deal with legacy of training Funding not required for maintenance- lease requirement of bus operator to contract bus manufacturer to provde maintenance, servicing and training.	2	3	6	01/06/2018	Active	Bus Operator as lease requirement to secure maintenance and servising contract with bus manufacturer- includes staff training
8	Critical path for the project.	C. The project timeline is to relient on following the funding deadlines; and third party actions	Long	3	3	9	Programme identified todate:- Access Road due for completion Sept 18 Buses due for final delivery March 19. (delivery will be in two phases 10 and 12) Bus Trials March 19 to July 19 Operation due July 19	2	2	4	01/07/2019	Active	Sylvia Broadley- BCC programme Management. Rachel Smith- ITM Power for

	Risk Identification *(inherent assessment)*						**Risk Mitigation** *(residual risk)*						
Ref	**Risk**	**C = Cause E = Effect**	**Proximity**	**Probability**	**Impact**	**Overall Score**	**Counter Measures - Underway and / or Planned**	**Probability**	**Impact**	**Overall Score**	**Action Date**	**Current Status**	**Risk Owner**
		E. There is a lack of a clear float and critical path.											hydrogen bus re-fuelling trials. Bus operator for driver training and route operation. David Horsfall for Tyseley Access Road.
9	Manufacturers not being able to offer the buses for the clients target price	C. The cost of the buses is more than the budget can afford to spend on the buses. E. The funding already secured for the project may not be able to accommodate an increase the price of the buses.	short	2	4	8	There is a limit on the price the bus manufacturers can charge under EU Legislation. The funding required is linked to the maximium price Two proposed manufacturers on a framework and mini competition for final price being developed.	1	3	3	01/03/2018	Active	Sylvia Broadley-Programme Management. David Waddington-Procurement. BCC Finance.
10	Development costs exceed budget	C. The cost of the development phase exceeds the budget by taking longer to develop or complexities not fully understood E. The funding already secured for the project may not be able to accommodate an increase the price of the buses.	short	2	4	8	The development phase is being funded by third party; including any additionals costs.	1	1	1	01/03/2018	Active	Sylvia Broadley-Programme Management.
11	Funding required before all buses delivered; and there is a failure to deliver all buses on time	C. Production and technical diffculties in development and construction E. Not all buses available before the in service date proposed.	Short	3	4	12	Payment terms for the delivery of the buses to be structured so that payments and final payments are linked to completed and delivery of the buses. Route can still be operated on existing buses and buses replaced with delivery of new hydrogen buses. LEP funding equates to 4.3 buses Having reasessed the payment schedule with the bus manufacturer via the framework agreement, it is comfirmed that 20% payment will be on order, 30% on part manufacturing and 50% on final delivery. This therefore means that contribution drawdown split is as follows: 2017/18 = £2.2m 2018/19 = £3.3m 2019/20 = £5.5m	2	3	6	01/01/2018	Active	Sylvia Broadley-Programme Management. BCC Finance.

ANNEX D – Project Plan

		Year 1 - 2017				Year 2 - 2018				Year 3 - 2019				Yeaar 4 - 2020				Future Years			
Activities	**End Date**	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	2021	2022	2023	2024
Key Project Milestones																					
Approval of FBC (Strategy)	Oct-17				■																
Bus operator procured	Jan-18					■															
Hydrogen infrastructure aligned with renewable energy systems.	Sep-18							■													
Hydrogen buses deployed on agreed route.	Oct-20																■				
Commercially viable price model developed for hydrogen fuel producion using renewable energy.	Dec-20																■				
Hydrogen Refuelling Infrastructure (HRI)																					
Site preperation completed for Tyseley Energy Park (TEP) re-fuelling hub development	Oct-17				■																
TEP detailed HRI design sign-off	Sep-17			■																	
Hydrogen infrastructure equipment installed	Apr-18						■														
Private wire/ renewable electricity connection secured	Jun-18						■														
Commisioning and testing complete	Sep-18							■													
Renewable energy system hydrogen production and storage start	Oct-18								■												
Hydrogen Bus Development and Deployment																					
Hydrogen bus Birmingham specification finalised	Jan-18					■															
Bus suppliers procured maintenance, parts & servicing contracts signed off	Mar-18					■															
Hydrogen Busesdelivered to Birmingham	Mar-19									■											
Peronnel training on HRI and bus operation training complete	May-19											■									
Maintenance regime established	May-19											■									
Clean Air Zone Hydrogen Bus route air quality impact assessment evaluation completed.	Dec-20																■				

ANNEX E – STAKEHOLDER ANALYSIS

Stakeholder	Stakeholder's Interest	Influence Impact	What does the project board expect from the stakeholder	Perceived attitudes and/or risks	Stakeholder management strategy	Responsible
Cabinet Member for Clean Streets, Recycling and the Environment	Endorses Full Business Case	High	Political support	Supportive	Consult during development stage and provide periodic progress reports during delivery	Air Quality Manager-Transportation & Connectivity , Projects Delivery.
Cabinet Member for Transport and Roads	Endorses Full Business Case	High	Political support	Supportive	Consult during development stage and provide periodic progress reports during delivery	Air Quality Manager-Transportation & Connectivity , Projects Delivery.
Cabinet Member for Health and Social Care	Endorses Full Business Case	Medium	Political support	Supportive	Consult during development stage as part of the wider air quality programme development	Air Quality Manager-Transportation & Connectivity , Projects Delivery
Chair of Licensing and Public Protection Committee	Endorses Full Business Case	Medium	Political support	Supportive	Consult during development stage as part of the wider air quality programme development	Air Quality Manager-Transportation & Connectivity , Projects Delivery

Stakeholder	Stakeholder's Interest	Influence Impact	What does the project board expect from the stakeholder	Perceived attitudes and/or risks	Stakeholder management strategy	Responsible
Chair of Planning Committee	Endorses Full Business Case	Medium	Political support	Supportive	Consult during development stage as part of the wider air quality programme development	Air Quality Manager-Transportation & Connectivity , Projects Delivery
Assistant Director Transportation & Connectivity	Endorses Full Business Case	High	Project support	Supportive	Full consultation and engagement, regular progress updates, meetings and Project Board and Investment Board involvement.	Air Quality Manager, Transportation & Connectivity , Projects Delivery
Director for Public Health	Endorses Full Business Case	High	Project support	Supportive	Full consultation and engagement as part of the delivery of emissions reduction supporting measures.	Transport Policy Manager.
Operational Manager for Air Quality and Environmental	Endorses Full Business Case	High	Project support	Supportive	Full consultation and engagement as part of the delivery of emissions reduction supporting measures.	Air Quality Manager-Transportation & Connectivity , Projects Delivery
BCC Officers from City Finance, Procurement and Legal and Governance	To develop and review Full Business Case	High	Project support	Supportive	Full consultation and engagement to ensure appropriate financing, procurement and legal requirements are in place.	Air Quality Manager-Transportation & Connectivity , Projects Delivery

Stakeholder	Stakeholder's Interest	Influence Impact	What does the project board expect from the stakeholder	Perceived attitudes and/or risks	Stakeholder management strategy	Responsible
Department for Environment, Food & Rural Affairs (DEFRA)- Joint Air Quality Unit	Endorses mitigating measures to tackle air quality problems.	High	Political support	Supportive	Full consultation and engagement as an additional measure for Clean Air Zone Business Case and mitigating action to impact emission reduction	Transport Policy Manager
Transport for West Midlands (TfWM) as part of the West Midlands Low Emission Bus Delivery	Endorses mitigating measures to tackle air quality problems as part of the regional plan for tackling transport emissions	High	Political support	Supportive	Full consultation and engagement as a key action to support the Strategic Bus Alliance and prioritising ultra-low/zero emission routes	Air Quality Manager- Transportation & Connectivity , Projects Delivery
Greater Birmingham and Solihull Local Enterprise Partnership (GBSLEP- Local Growth Funding)	Approves LGF funding, due diligence process, agrees offer letter, process claims and monitoring of programme.	Medium	Financial support, Due Diligence, agreement of Offer letter and performance monitoring of project, payment of claims.	Supportive	Quarterly claims, regular monitoring reports and contact as appropriate. Alignment of investment benefit to carbon emission reduction, levering economic investment and economic outcomes	Air Quality Manager- Transportation & Connectivity , Projects Delivery

Stakeholder	Stakeholder's Interest	Influence Impact	What does the project board expect from the stakeholder	Perceived attitudes and/or risks	Stakeholder management strategy	Responsible
Office of Low Emission Vehicles (OLEV)-Low Emission Bus Scheme	Approves LEBS funding, due diligence process, agrees offer letter, process claims and monitoring of programme.	Medium	Financial support Due Diligence, agreement of Offer letter and performance monitoring of project, payment of claims.	Supportive	Quarterly claims, regular monitoring reports and contact as appropriate. Alignment of outcomes of impact of innovative technology, operating costs and NOX emissions	Air Quality Manager-Transportation & Connectivity , Projects Delivery
Fuel Cell and Hydrogen Joint Undertaking (FCH JU)	Approves FCHJU funding, due diligence process, agrees offer letter, process claims and monitoring of programme.	Medium	Financial support, Due Diligence, agreement of Offer letter and performance monitoring of project, payment of claims.	Supportive	Quarterly claims, regular monitoring reports and contact as appropriate. Alignment to outcome of commercial viability of bus cost and fuel costs.	Air Quality Manager-Transportation & Connectivity , Projects Delivery
Webster & Horsfall	Land owner of Tyseley Energy Park (TEP) and developer of the low/zero emission re-fuelling hub.	High	Developer support	Supportive	Hydrogen re-fuelling infrastructure deployment with hydrogen buses as anchor fleet aligned with the development of the access road and re-fuelling hub development.	Air Quality Manager-Transportation & Connectivity , Projects Delivery

Stakeholder	Stakeholder's Interest	Influence Impact	What does the project board expect from the stakeholder	Perceived attitudes and/or risks	Stakeholder management strategy	Responsible
Hydrogen infrastructure providers and hydrogen bus manufacturers	Updates on project development details and procurement framework details and deadlines.	High	Industry support	Supportive	Hydrogen market development for re-fuelling and deployment of buses, the relevant supply chains and fleet transition to hydrogen.	Air Quality Manager - Transportation & Connectivity , Projects Delivery
'Energy Capital' - University of Birmingham and Aston University	Updates on project developments and alignment of R & D activities , education and skills development agenda	High	Education and Training support	Supportive	Alignment with centre of excellence development to capture education and skills development agenda from apprenticeships to degree level courses.	Air Quality Manager- Transportation & Connectivity , Projects Delivery