Project Code/Version Number:
NGNGN03

1. Project Summary

1.1. Project Title	The City CNG Project
1.2. Project Explanation	The City CNG Project will build the UK's first scalable compressed natural gas fuelling station for back to depot city based vehicles. It will do so using a novel commercial arrangement to initially fund the high pressure connection and provide a proof of concept business case to enable future private sector investment.
1.3. Funding licensee:	Northern Gas Networks Limited
1.4. Project description:	*1.4.1. The Problem(s) it is exploring:* Due to absence of large scale CNG fuelling stations within the UK there is limited opportunity for depot based city vehicles to convert to Compressed Natural Gas (CNG). There is no proven economic business case to build a large scale city based CNG fuelling station to allow for significant conversions of large numbers of city based vehicles. The high level of upfront capital cost for both the station and associated High Pressure (HP) connection is preventing investment. *1.4.2. The Method(s) that it will use to solve the Problem(s)* The City CNG project will build a city based CNG station as a demonstration project to prove the economic business case for this technology. A novel commercial arrangement will be established to allow costs associated with the high pressure connection to be recovered over time linked to station throughput. Technical complexities associated with the design and build of high pressure connection to such a station will be resolved. *1.4.3. The Solution(s) it is looking to reach by applying the Method(s)* The solution will address the three key objectives of the project: **Objective One:** provide a 'build it and they will come' proof of concept for UK cities with the ambition of providing the business case for private sector investment in large scale city based CNG stations. **Objective Two:** The project will explore a novel commercial arrangement for providing HP connections to CNG fuelling stations. **Objective Three:** Identify and resolve the associated technical complexities for design and build of HP connections associated with this type of infrastructure. *1.4.4. The Benefit(s) of the project* The City CNG project has some financial benefits back to gas customers associated with the novel commercial arrangement and potential for cheaper fleet fuel costs and associated reductions in operating expenditure. The most significant benefits arise as a

	result of reductions in Particulate Matter, Nitrous Oxides and Carbon dioxide. The potential projected financial benefits associated with these emissions savings equates to circa £1.5m in a ten year period.		
1.5. Funding			
1.5.1 NIC Funding Request (£k)	£1,095	1.5.2 Network Licensee Compulsory Contribution (£k)	£123
1.5.3 Network Licensee Extra Contribution (£k)	£0	1.5.4 External Funding – excluding from NICs (£k):	£0
1.5.5. Total Project Costs (£k)	£1,231		
1.6. List of Project Partners, External Funders and Project Supporters	Leeds City Council		
1.7 Timescale			
1.7.1. Project Start Date	01 December 2015	1.7.2. Project End Date	31 October 2019
1.8. Project Manager Contact Details			
1.8.1. Contact Name & Job Title	Dan Sadler, Head of Energy Futures	1.8.2. Email & Telephone Number	dsadler@northerngas.co.uk T: 0113 397 5381 M: 07584 391466
1.8.3. Contact Address	Northern Gas Networks, 1100 Century Way, Thorpe Park Business Park, Colton, Leeds LS15 8TU		
1.9: Cross Sector Projects (only include this section if your project is a Cross Sector Project).			
1.9.1. Funding requested the from the [Gas/Electricity] NIC (£k, please state which other competition)			
1.9.2. Please confirm whether or not this [Gas/Electricity] NIC Project could proceed in the absence of funding being awarded for the other Project.			

Section 2: Project Description

2.1. Aims and objectives

Emissions reduction of transport in the UK and associated air quality improvement
There are several small Compressed Natural Gas (CNG) fuelling stations around the UK (see section 3 for examples) which serve specific limited customer bases. These existing stations are predominantly for the use of long distance HGV type vehicles and small bus fleets. Currently no locations exist in the UK to accommodate the large scale conversion of city based vehicles to CNG. These vehicles could include any depot based vehicles for example refuse trucks, buses, local taxis, fleet vans.

The most significant obstacle to accelerating the step change towards CNG vehicles and the associated cost and emissions reduction is the lack of a proven economic business case to build a large scale city based CNG fuelling station. The City CNG Project will provide this business case as a UK proof of concept accelerating private sector investment and the onset of the CNG market. The upfront cost of the High Pressure (HP) connection will be funded via the NIC and paid back as the station becomes economically viable, with the level of repayment linked to throughput. This means that the funds associated with the HP connection costs of the fuelling station, subject to the station becoming economically viable, will be at zero cost to UK gas customers.

Key objectives:
Objective One: The project will act as a 'build it and they will come' proof of concept for UK cities with the ambition of providing the business case for private sector investment in large scale city based CNG fuelling stations.

Objective Two: The project will explore a novel commercial arrangement for providing HP connections to CNG fuelling stations.

Objective Three: The project will identify and resolve the technical complexities regarding the size, design and build of HP connections associated with this type of infrastructure.

The Problem
The absence of large scale CNG fuelling stations specifically for a mix of city based vehicles within the UK, is limiting the opportunity to move to CNG vehicles from conventional fuel sources. This is prohibiting the opportunity for significant reductions in operating costs, emissions and associated air quality and public health improvement. CNG offers the opportunity for a vehicle fuel that is cheaper, less volatile to price fluctuations than diesel/petrol and proven to reduce Particle Matter (PM), 100%, Nitrogen Oxide (NO_x) by circa 90% and carbon emissions by circa 22% compared to diesel vehicles.

There is no proven economic business case to build a city based CNG fuelling station to support large scale conversion of city based vehicles. There is also no UK example of gas for such a station being taken directly from the gas HP network which ensures both security of supply and scalability of the station. Taking supply directly from the HP system also reduces the amount of compression required at the fuelling station thus reducing the build and operating costs of the station.

The high level of upfront capital cost for both the station and associated HP gas connection is preventing investment. This is based on two significant risks: firstly, the lack of evidence for the time it could take for the station to become economically viable driven by the number of vehicles converting over time; secondly, technical complexities as a station has not been connected to the UK HP network before.

Until a fuelling station is built which can provide a proven case study for large scale city based UK deployment of CNG vehicles the private sector is unwilling to invest. Leeds City Council's (LCC) market tests show the private sector is currently unwilling to take the risks associated with funding and constructing the HP connection required. This is having a significant and detrimental impact the reduction in environmental emissions that can be achieved using CNG vehicles and the resulting improvements in air quality and health benefits for UK cities.

Currently there is no commercial mechanism to allow deferred payment of HP connection costs with the ability to pay back (including interest) based on the throughput of a CNG fuelling station over time to encourage private sector investment in this alternative fuel infrastructure.

The Method and Trials

To date Leeds City Council (LCC) have embarked upon a significant journey to ascertain the benefits of gas as a vehicle fuel for its Refuse Collection Vehicle (RCV) fleet. This has included:

- 2009/10 trialling of two RCVs from a temporary filling station.
    - Mercedes-Benz Econic LLG running on Liquefied Natural Gas (LNG) alone.
    - A Dennis Eagle Elite, duel fuel diesel/LNG.

The final report on the trial (LCC Cenex report, see appendix D) concluded that dedicated gas provided the best results and delivered a significant reduction in emissions over its diesel counter parts. It surmised that there was a reasonable chance of it being financially beneficial taking into account the high vehicle costs but substantial reduction in fuel costs.

- 2011 to present – construction of a permanent LNG fuelling station with capacity for five RCVs and seven small vans which had the ambition of:
    - Extending the usage of gas as a fuel to test the longer term reliability of the vehicle.
    - Increasing the number of alternatively fuelled vehicle types on the LCC fleet.
    - Reducing operational costs associated with continuing to lease a temporary station.
    - Understanding security of supply.

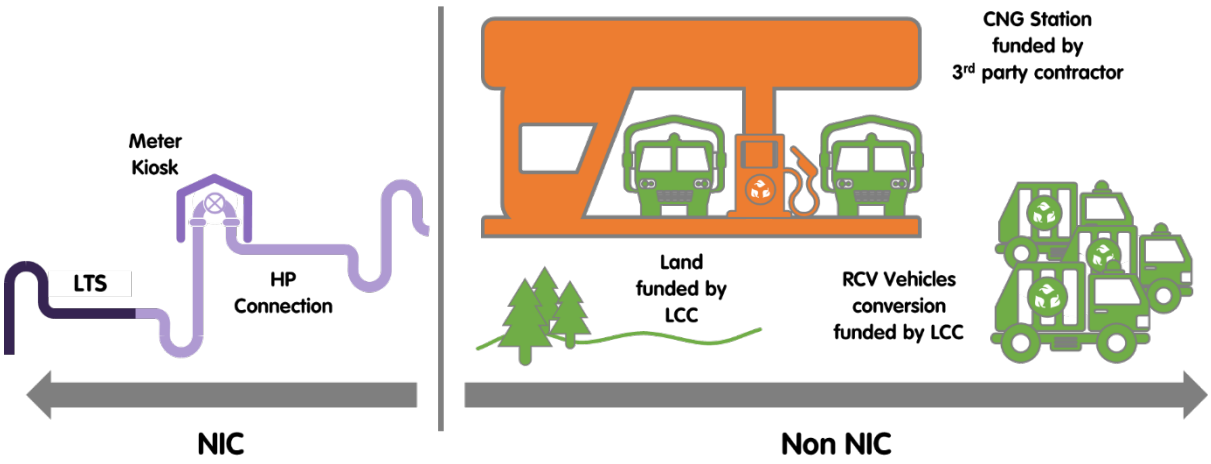
Fuel use and service data (see section 4) obtained from the operational lifespan of the RCVs supported the decision to increase the deployment of gas. However, supply issues of LNG and the capacity of the site are prohibiting this expansion without the deployment of a large scale CNG fuelling station with security of supply established from the Local Transmission System (LTS).

- Soft market test – LCC have undertaken two soft market tests to ascertain the appetite of the private sector (see appendix D for summary) to provide investment for the design and build of the CNG fuelling station. The soft market tests indicated the following:
    - Soft market test one (2013): The private sector felt the investment was too significant noting the unproven UK business case specifically citing the HP connection costs

- Soft market test two (February 2015): The HP connection was removed from the soft market test after which two of four companies confirmed they would provide the investment

In light of the above, and in line with NGN's RIIO business plan aspiration 'to support the onset of the CNG market' The City CNG Project will incorporate the design and build of a city scale CNG fuelling station on the outskirts of Leeds City Centre. The NIC aspect of this project only applies to the HP connection, meter unit and knowledge dissemination as identified on the diagram below.

Figure 1: Project diagram



The NIC aspect of The City CNG Project will incorporate four elements:
Exploration of a novel commercial arrangement – whereby the repayment for the HP connection will be recovered (including RPI) based on throughput over a 10 year period, with any outstanding sums owing after that period potentially being written off, though we are not expecting this to occur.

Establishment of the alternative use of the LTS – including the technical parameters associated with the optimised design of a HP connection to facilitate an unknown growth profile of the CNG market. This will allow an understanding of the vehicle rate of conversion over time and impact on HP connection sizing and design for a CNG fuelling station. It will also consider optimised fuelling times to keep connection sizes to a minimum.

Knowledge dissemination – a web portal documenting the performance of the CNG fuelling station, lessons learnt, case studies for vehicle conversion and ultimately providing the evidence for the business case associated with city based CNG fuelling stations.

Marketing support – to help promote the station and canvas expertise / case studies from around the globe especially Europe. This will ensure all appropriate information is collated and updated onto the web portal in a user friendly format to help support other cities / organisations in the UK establish their own CNG fuelling station should it prove successful.

A successful project will provide the following:

- A proof of concept business case for city based CNG fuelling stations.

- A test case for ongoing justification (or not) for the use of this novel commercial arrangement for city based CNG fuelling stations. The project may prove that this commercial incentive is not required as the conversion rate of vehicles is significant enough to remove the risk of the upfront investment.
- A case study for the UK gas industry to understand the technical complexities associated with design and build of a HP connection to a customer where the scale of operation is currently unproven.

2.2. Technical description of the Project

In order to meet the objectives the following will be undertaken.

Objective One: Development of a proof of concept business case for a city based CNG fuelling station.

In order to provide the proof of concept business case the performance and operation of the station will be available in the public domain via a web portal. It is anticipated that web portal will show the following data as a minimum, which can be used for all subsequent city based CNG fuelling station connections. All data would be represented daily, weekly, monthly and yearly:

- Station throughput and performance
  - Throughput at the meter point – throughput at the billing meter point for the station.
  - Throughput at the pump – noting there will be storage on site this will demonstrate the difference in time between the time when gas is taken from the network and the time it is used at the station i.e. when vehicles fill up.
- Vehicle conversion rates – the amount and type of vehicles that have converted to CNG and have started to use the station will be available in both a case study (where appropriate) and graphical format.
- Appropriate case studies explaining the challenges of conversion, costs and projected/realised operational savings of converting to CNG.
- Europe/worldwide case studies: Any case studies from around Europe and/or the world that would assist in understanding the CNG benefits model and the art of the possible.
- Useful links: Links to any other useful information including organisations

Normally some of the above data may not be provided by a private sector station operator but it will be a condition of the agreement that such information must be provided.

The City CNG Project will build a city scale CNG fuelling station in Leeds with the associated conversion of an 'anchor load' of vehicles from the LCC's RCV fleet. A proactive stakeholder campaign will run in tandem with the build and operation of the station to provide technical support (how to convert vehicles, where to purchase vehicles, logistics of operation etc.) to other organisations with back to depot vehicles to convert to CNG. This could include any depot based vehicles for example buses, taxis and local van fleets including NGN vans.

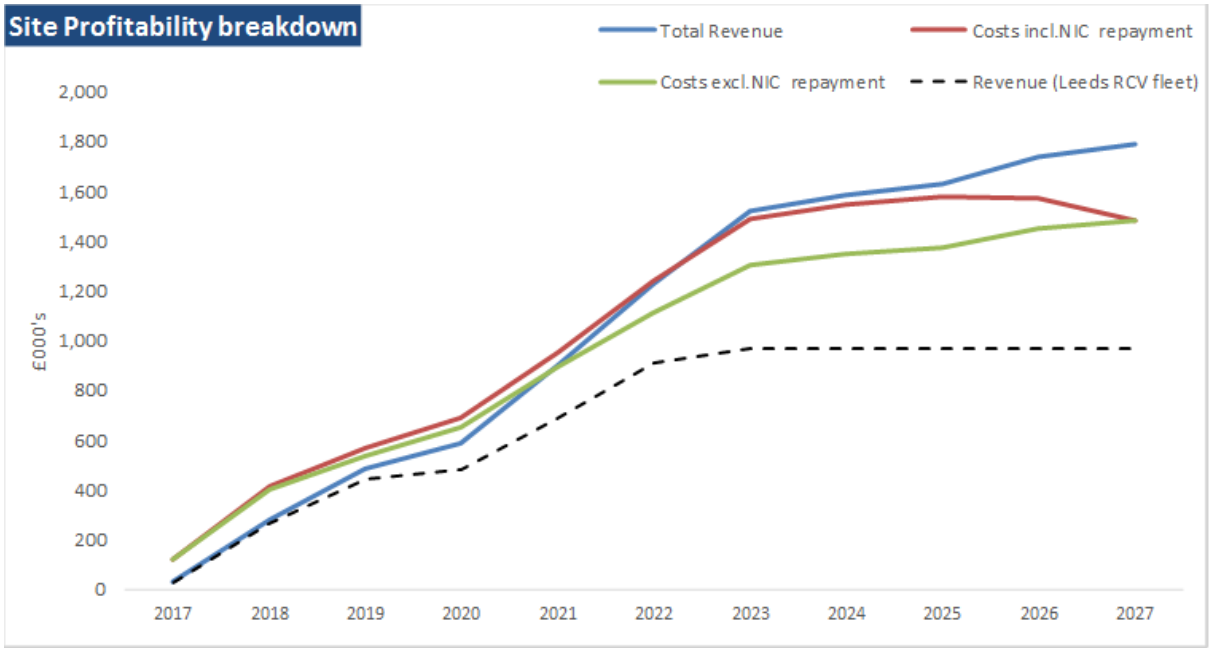
Objective Two: Novel Commercial Arrangement

Currently any new connection to the gas distribution network is required to pay up front for the cost of the connection. As this is a significant barrier for CNG stations a novel commercial arrangement will put in place under The City CNG Project.

The overall value of the HP connection will be recoverable based on throughput bands over a period of 10 years from the date that the facility first becomes operational. This recovery mechanism has been agreed in principle with LCC (see appendix C, letter of support, executive board paper and minutes) and is based on a scaling level of repayment linked to throughput of the station i.e. as more vehicles convert the level of repayment will accelerate. This mechanism will have a defined lifetime of 10 years after which any outstanding debt will be written off. The recovery of the costs associated with the HP connection/metering will be inclusive of a set interest charge. This means, provided the throughput of the station is in line with current projections, there will be no cost to UK gas customers associated with the overall build of the CNG fuelling station.

In order to understand the likelihood of commercial recovery the total cost of operation for the CNG fuelling station has been modelled over a 10 year period (see appendix H, Business Model Spreadsheet). Pessimistic, realistic and optimistic scenarios have been modelled to give an indication of the risk of recovering the NIC funds under the novel commercial arrangement. The realistic scenario (on which the payback mechanism is set) has been based on tangible evidence and discussions with independent operators via LCC. All assumptions behind these scenarios can be found in section 4. It is worth noting that these projections are still considered conservative for all scenarios. This is because they are based on evidence from a limited number of organisations and, in reality, there are far more organisations within the Leeds area that are yet to be contacted and who could use the CNG fuelling station (or set up a 'daughter' station as defined in the Joulevert CNG Feasibility Study, see appendix D) as a viable alternative to their current diesel fleet.

Graph 1: Site profitability - with and without NIC loan repayment



Graph 1: Site profitability - with and without NIC loan repayment, is based on the 'realistic scenario' for conversion of CNG vehicles. The novel commercial arrangement

will allow reduced payments of the HP connection in the early years of the station's operation increasing more rapidly as throughput increases.

The commercial mechanism for recovery of the connection costs is based on a banded return percentage linked to throughput. NGN have undertaken some initial financial modelling to provide an example of the proposed payment mechanism. Two options of payment linked to throughput have been modelled: option one is based on a linear repayment; option two is based on a banded repayment whereby the return increases as throughput of the station increases. The tables below demonstrate the different commercial recovery approaches.

Table 1: Option 1 – linear repayment based on throughput (suggested 10 year pay back just linked to throughput).

Throughput Kwh	14,743	143,584	244,586	298,878	450,851	616,583	770,119	822,027	875,207	942,571	989,077	6,168,224
% of maximum by year 10	1.5%	14.5%	24.7%	30.2%	45.6%	62.3%	77.9%	83.1%	88.5%	95.3%	100.0%	
Amount borrowed												971,000
Rates Kwh												0.16
Throughput x unit rate	2,321	22,603	38,503	47,049	70,973	97,062	121,232	129,403	137,775	148,379	155,700	971,000
Cumulative repayment	2,321	24,924	63,426	110,476	181,448	278,511	399,743	529,146	666,921	815,300	971,000	

Table 2: Option 2 – Banding repayments linked to throughput – (bandings approach)

	Unit rate as per linear profile	Unit rate per linear profile	Bandings variation	Unit rate would be
0 – 250,000 Kwh (roughly 0 – 25%)	Less 50%	0.16	-50.0%	0.08
250,000 – 500,000 Kwh (roughly 25-50%)	Less 25%	0.16	-25.0%	0.12
500,000 – 750,000 Kwh (roughly 50-75%)	Plus 25%	0.16	25.0%	0.20
Above 750,000 Kwh	Plus 50%	0.16	50.0%	0.24

At this stage it is anticipated that the banding commercial approach will be adopted for The City CNG Project (bandings to be agreed with LCC). This will allow reduced payments in the early years of the station but increase recovery as the station throughput increases.

The contract underpinning this novel commercial arrangement will be in place between NGN and LCC. The heads of terms for this contract have been broadly agreed between LCC and NGN (see appendix C, Letters of support) and are summarised below:

Key aspects of the commercial arrangement:

Contracts:

- The connection contract will be between NGN and LCC.

Timescales

- The payback period will last 10 years from the date the station is commissioned.

- The connection agreement will be signed between NGN and LCC before any works are committed on the HP connection.
- If the HP connection is not repaid after 10 years post commissioning all outstanding sums owed will be written off.

Details

- LCC and/or its 3rd Party Contractor will be available to supply all required information for the production of the bi annual/annual report to be used as part of the NIC reporting process.
- Recovery of the NIC funds will be linked to banded commercial returns based on a percentage of throughput as described in
  Table 2: Option 2 – Banding repayments linked to throughput – (bandings approach).
- The total value to be recovered will be the original value of the NIC plus RPI and this will be monitored and reported by NGN.
- Recovery payments will be made back to the original NIC bank account.

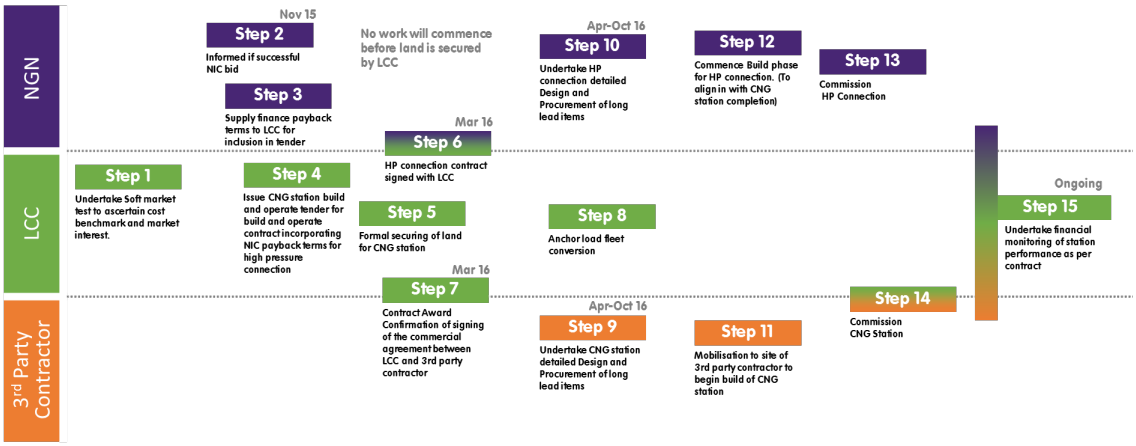
For clarity the total NIC funding requested is split between the HP connection, metering costs and the marketing/web portal which is required to support the success of the station and disseminate knowledge to facilitate UK wide adoption of city based CNG. Only the costs associated with the HP connection and metering are subject to recovery under the novel commercial agreement. The other costs incurred are not specific to this project but are for the wider benefit of the UK gas industry and CNG market. The marketing will support the success of the CNG fuelling station which ensures repayment of the HP connection whilst the web portal will showcase this project allowing the rapid take-up of LTS fed city based CNG fuelling stations across major UK cities. This will be to the benefit of UK gas customers both in terms of cost, improved air quality and emission reductions (see section 3).

Reducing commercial exposure

Consideration has been given to commercial exposure of the HP connection if LCC were unable to complete the city based CNG fuelling station (see section 6 – reasons to suspend the project). A robust process will be put in place monitored by the NIC City CNG Steering Group (see appendix B).

This process will ensure costs associated with the design and build of the HP connection are only committed once specific milestones have been achieved by LCC. The key milestones are:

Figure 2: Contractual process flow



Objective Three: Technical complexities of the HP connection/meter unit.

To date there has been no connections to the HP UK gas network for a city based CNG fuelling station. This project will connect directly to NGN's 17bar Local Transmission System (LTS). There are several complexities associated with the design, sizing and safety considerations of a connection to facilitate a scalable CNG fuelling station. In reality, the complexities relate to both the infrastructure upstream of the CNG fuelling station i.e. the HP connection and HP meter unit and also the station itself. Whilst noting these complexities, the technology is already at the correct Technology Readiness Level (TRL) to be built (7-8).

For the HP connection and meter skid unit throughput is the major consideration as the maximum throughput demand for the station is currently unknown. This could be significant (see appendix H, Business Model Spreadsheet) if there is mass conversion of vehicles or it could be based solely on the LCC RCV truck conversion. This problem also extends to the HP meter skid unit which will need to be designed to accommodate a scaling station which would mean a twin stream unit whereby the meter is changed at a point in time when the original meter reaches full capacity.

Safety considerations for the HP connection will need to be taken into account during the design phase and signed off as part of the G17 design assurance process. A detailed HAZOP (Hazards through operation) will need to be undertaken incorporating a compressor study to ensure the operation of the compressor has no detrimental effect on the upstream NGN network. The compressor study will need to consider the potential of a station that is going to increase capacity over time and potentially add more on site storage and/or compression capability. As such a HAZOP may identify that the Emergency Control Valve (ECV), i.e. the valve at the 'end' of the NGN network, should be remotely operable back to NGN's system control so it can be isolated in the event of a pressure drop on the LTS network.

When the project is considered as a whole, it will provide demonstrable evidence for HP connection sizing, associated metering and other downstream complexities that need to be taken into account when optimising design for CNG city based fuelling stations. By understanding the scaling profile for these stations i.e. volume conversions over time, it will be possible to design optimised connections and clear connection guidelines for this type of infrastructure for use by other networks.

As part of the web portal the CNG fuelling station will be designed to provide real time data for public review as understanding the operational dynamics of a city CNG fuelling station will be useful for all other networks when considering connection sizing for future CNG city based fuelling stations which may connect to different points on the network e.g. the 7bar or 17bar with less flexible capacity etc. This information will be critical to optimised sizing of HP network connections and it will provide case study evidence which may support timeslot refuelling contracts with large providers. Such contracts will enable a flat profile of use for optimum station efficiency and minimum vehicle waiting times at the station forecourts. It may also be used to mitigate any capacity risk associated with the gas network by, for example, ensuring RCVs do not all fill up at peak gas daily demand times if that would cause a capacity issue on a network.

Table 3: NIC Scope below summarises what is in and out of scope associated specifically with the NIC funding.

Table 3: NIC Scope

In (NIC) Scope	Out of NIC scope (not requiring funding)
Commercial Arrangement • Development of commercial arrangement. • Monitoring of ongoing commercial status of CNG fuelling station once commissioned. • Recovery of NIC funds associated with the HP connection. **Technical Arrangement** • Design of the HP connection and metering skid. • Land easements associated with the HP connection. • Procurement of all associated materials for the HP connection. • Build and commissioning of the HP connection. **Other** • Development of a web portal for knowledge dissemination • Marketing support for the first three years	• Land purchase. • Planning permissions associated with the station. • Conversion of RCVs. • Conversion of other vehicles. • LCC arrangements associated with the build / operate contract for the CNG fuelling station. • Build of CNG fuelling station.

2.4. Changes since Initial Screening Process (ISP)

The scope of the original proposed project has been amended slightly since being submitted as part of the initial screening process. The following scope changes have occurred:

- Through internal challenge, discussions with LCC and their associated meter service provider, the HP meter has been included in the NIC bid and will be recovered under the novel commercial arrangement.

The costs submitted in the bid, compared to those submitted during the initial screening process have changed as follows:

- **HP connection costs.** Up from £700,000 to £921,495 following a detailed pricing exercise (see section 3);
- **HP Meter Skid.** Additional costs of £50,000 included;
- **Website costs.** Down from £500,000 (previously included stakeholder support as well) to £200,000. This is following benchmarking the web portal costs against NGN's successful 2013 Low Carbon Gas Pre-heating (LCGP) NIC bid;
- **Marketing.** Costs separated from website and included at £60,000.

Section 3: Project business case

3.1 Background

Transport accounts for around 27% of the global total of energy consumption, 62% of oil consumption is within this sector. The International Energy Agency (IEA) estimates that there are 50 million trucks worldwide compared to 850 million passenger cars. Despite trucks being a relatively small proportion of the overall transport mix, the size and weight means they account for 60% of diesel sold. The City CNG Project is using LCC's Refuse Collection Vehicle (RCV) fleet as its anchor load for the Compressed Natural Gas (CNG) fuelling station. These vehicles, based on their mode of operation, are one of the worst polluters in the city so the emissions benefits from this CNG fuelling station, even under pessimistic projections, (see appendix H, Business Model Spreadsheet) are significant. Simply put they spend most of their time driving round in first or second gear.

The technology associated with CNG vehicles and fuelling stations is well understood. A report issued by the Oxford Institute for Energy Studies in March 2014 provides a large amount of evidence in support of CNG as both a technology and environmentally beneficial fuel based on evidence from Europe.

The key barriers to the onset of the natural gas market in transportation is the lack of refuelling infrastructure and the resultant limited number of vehicles being manufactured for the UK market. The Chancellor of the Exchequer announced that the current 50% fuel duty differential between gas and diesel will be held at the current level to 2024 indicating the Government's desire to promote the environmental benefit of gas vehicles. This also reduces the investment risk for the short and medium term to encourage development in the gas fuel marketplace.

Whilst recognising the benefits of gas fuelled vehicles deriving from lower fuel costs and improved emissions performance The Oxford Institute for Energy Studies report highlights three critical issues which currently need to be weighed against these benefits (section 3 p11):

- Switching to natural gas will almost certainly entail higher upfront costs.
- The 'chicken and egg' syndrome is hampering the development of an effective refuelling infrastructure.
- The risk of switching to a relatively untried (in Europe) fuel compared to the safe current option.

Figure 3: The City CNG ambition: A CNG fuelling station in China

LCC specific preliminary research results:

As detailed in section 2 Leeds City Council (LCC) have embarked upon a significant journey to ascertain the benefits of CNG as a vehicle fuel for its RCV fleet (see section two for full details). This has included:

- 2009/10 trialling of two RCVs from a temporary filling station.
- 2011 to present – construction of a permanent Liquefied Natural Gas (LNG) fuelling station with capacity for five RCVs and seven small vans.

- Soft market test – LCC have undertaken two soft market tests to ascertain the appetite for the private sector to provide investment for the design and build of the CNG fuelling station (see appendix D, Evidence).

The initial results have provided enough justification to LCC to demonstrate that a city based CNG fuelling station could have significant cost and environmental benefits for the city. However, the RCV fleet alone cannot justify the high upfront costs of the station and associated High Pressure (HP) connection.

3.2 Project financial benefits

This project will predominantly deliver significant environmental benefits through reductions in Particulate Matter (PM), Nitrogen Oxide (NO_x) and carbon emissions which benefit all gas customers and the wider public. It will make a very significant contribution to improving air quality in Leeds. The net direct financial cost to gas customers is expected to be less than £250,000 with direct financial benefit for gas customers through reductions in unit transportation charges from greater use of the gas distribution network and potential reductions in NGN operating costs through use of CNG vehicles.

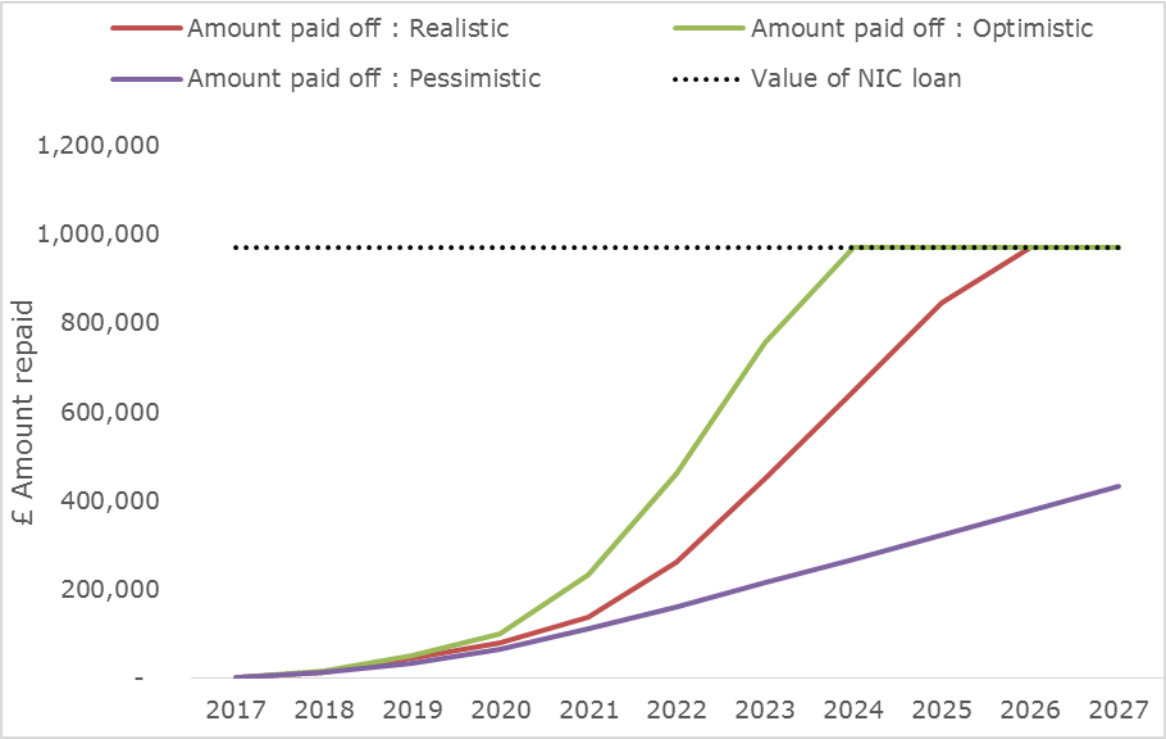
To understand the benefits of the project including the likelihood of recovering the NIC costs associated with the HP connection a detailed business model has been produced (see appendix H, Business Model Spreadsheet). Conversion rates of vehicles and total cost of operation for the CNG fuelling station has been modelled over a 10 year period. Pessimistic, realistic and optimistic scenarios have been produced. The realistic scenario for vehicle conversion rates has been based on tangible evidence and discussions with independent operators provided via LCC. All assumptions behind these scenarios can be found in section 4.

The profiles for vehicle conversion required to realise these benefits are summarised below:

- Short term (one to five years, from commissioning) – in the short term there will only be minimal financial recovery as the station throughput will increase relatively slowly. There will however be significant air quality and emissions benefits. The emissions benefits are significant in this early period as the first vehicles to convert would be the LCC RCVs which are one of the worst transportation polluters in the city.
- Medium term (five to ten years, from commissioning) – by year five significant numbers of vehicles in the Leeds area will have converted to CNG providing rapid recovery of NIC HP connection costs and large emissions benefits to UK plc. NGN fleet vehicles based at Leeds depots will have begun to convert (circa. 20) and there will be significant numbers of other vehicles converting. Within this period it is anticipated that other city based CNG fuelling stations will begin to be constructed. The benefits thereafter will have begun to increase exponentially.
- Long term (10 years and above) - at 10 years large numbers of vehicles will have converted and there will be an exponential increase in city based CNG fuelling stations providing significant financial and emissions benefits to UK plc.

Graph 1: Site profitability - with and without NIC loan repayment, in section 2 shows anticipated throughput of the station and payback of the NIC funds under the novel commercial arrangement as described in section two.

Graph 2: NIC funding repayment

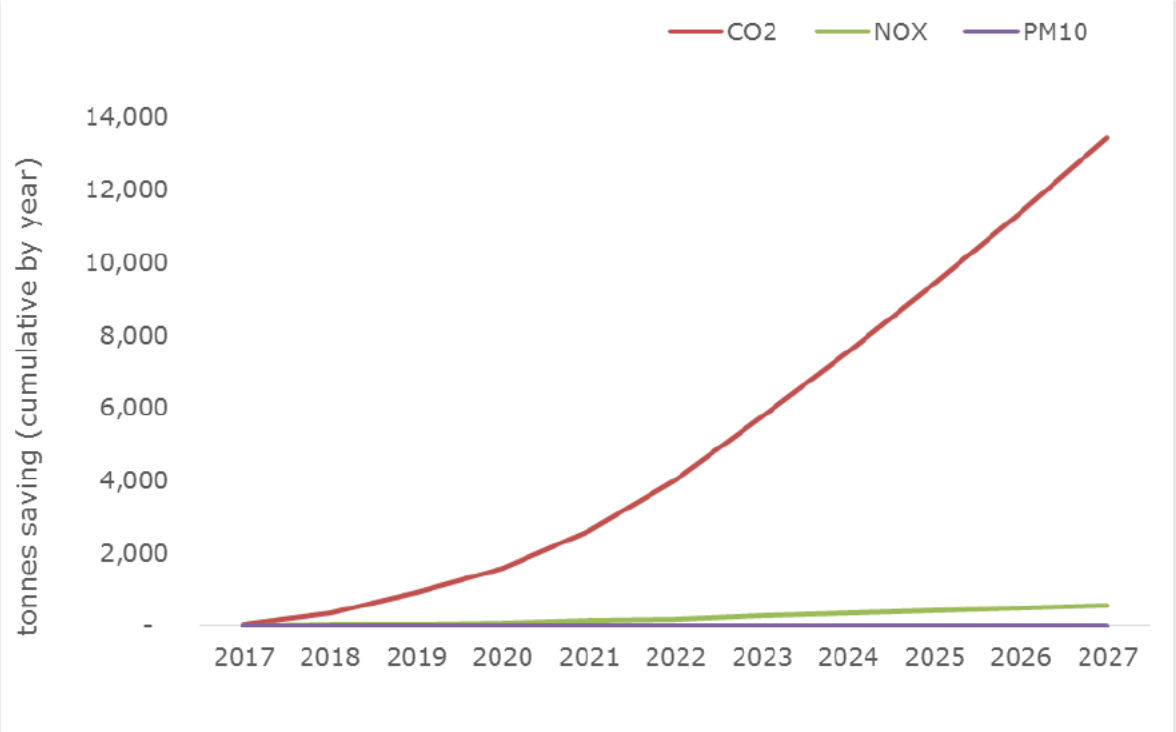


Under the realistic projection scenario using the proposed commercial banding (as described in section two) the NIC funds associated with the HP connection would be recovered in full (including RPI) within the 10 year period.

Potential Opex Savings: NGN are currently investigating the conversion of their Leeds based van fleet to CNG and subject to a successful NIC bid, will be undertaking a trial of a gas engine vans in 2016 to ensure it is appropriate for the operational parameters of these vehicles on the gas network. Currently NGN's Light Commercial Vehicles (LCV) in the Leeds area have an average fuel cost per annum of circa £2,400. A conversion to CNG with an average anticipated fuel reduction of circa 40% (based on the LCC trials) would provide an annual saving of £960 per vehicle. In Leeds there are around 60 vehicles that could potentially convert providing an overall Opex saving of £57,600. Under the IQI mechanism this would return 36% back to customers providing a circa £20,000 per annum return. If The City CNG Project provides the stimulus for all major cities in the UK to build similar stations this return will increase significantly. NGN will commit to converting a minimum of 15 vans in the Leeds area if the NIC bid is successful and the station is built.

The use of CNG as fuel for transport and the associated emissions reductions are well proven (see appendix D, Evidence and section 4). Projects have been undertaken into the overall emissions savings against the pessimistic, realistic and optimistic scenarios for vehicle conversions. Graph 3: Total Emissions Savings below demonstrates the project emissions savings.

Graph 3: Total emissions savings (realistic scenario)



These emission savings are summarised and financially quantified below.

Table 4: Emissions savings

Emission Type	Total reduction (in Tonnes)	Cost per Tonne (As per DECC/DEFRA)	Total saving on non-traded costs of emissions
PM10	0.706	£70,351.00	£49,681
Nitrous oxide	572	£955.00	£546,119
Carbon	13,424	£61.8	£829,467

Over a ten year period the projected financial benefits associated with emission savings for the Leeds City CNG fuelling station are:

£1,425,267

These emission benefits projections are for one city (Leeds) and are based on a very conservative 'realistic projection' of vehicle conversions.

In reality, should the economic business case be proven, this emissions benefit could be extrapolated across the eight core UK cities with total benefits to UK plc in excess of £11.4m over a ten year period. This will also have benefits for UK city air quality and the many associated positive health implications.

When considering a full cost benefit analysis for the CNG fuelling station, incorporating the non-traded costs of emissions as detailed in Table 4: Emissions savings, the station's payback period would be recovered in seven years (appendix H, see Business Model Spreadsheet).

Other significant indirect benefits will come from proven health improvements (see section 4) in the Leeds area as a consequence of improved air quality and cheaper operating costs for public sector vehicles (RCVs, buses etc.) in Leeds which could ultimately be passed onto the customer. If The City CNG Project does justify city scale CNG fuelling stations the benefits will increase exponentially.

3.4 Project financial costs

The overall project funding is summarised in Figure 1: Project diagram in section 2 and the overall costs in the Table 5: NIC/ Overall Project Cost (see appendix A for full breakdown) below.

Table 5: NIC/ Overall Project Cost (see appendix A for full breakdown)

No	Project Element	Funding Provider	Cost	Contingency	Total Cost	Recoverable under NIC commercial agreement
1	HP connection	NIC	£801,300	£120,195	£921,495	Y
2	HP meter	NIC	£40,000	£10,000	£50,000	Y
3	Web portal	NIC	£175,000	£25,000	£200,000	N
4	Marketing	NIC	£50,000	£10,000	£60,000	N
Sub-Total NIC					**£1,231,495**	**£971,495**
5	Land	LCC	£600,000	£60,000	£660,000	N/A
6	RCV conversion	LCC	£1,500,000	£150,000	£1,650,000	N/A
7	CNG fuelling station build	3rd Party	[redacted]	[redacted]	[redacted]	[redacted]
Sub Total 'Others'					[redacted]	[redacted]
Project Total					[redacted]	[redacted]

Item 1- NGN HP connection estimate

Three sites have been identified as being both within land accessible to LCC and close enough for a connection to NGN's LTS to be carried out without being cost prohibitive. These costs have been prepared using historic data from previous Local Transmission System (LTS) connection and diversion projects, and have a 15% uplift applied for risk. The connection to the CNG fuelling station will be carried out to IGEM standards and NGN procedures, and as such should not pose any problems which have not been encountered in previous LTS connection and diversion projects. The actual construction will be tendered between a range of competing contractors.

The complexity of the project will be at the interface between NGN's Emergency Control Valve (ECV) (the defined boundary of NGN's pipeline and asset), the meter provider and the CNG fuelling station. This will require each party's design to be integrated to ensure the suitability of the new installation. The costs include an allowance to make the ECV installed at the defined boundary remotely operable, to allow for the CNG fuelling station

flow to be monitored and operated. This is important as NGN needs to have the option to limit the volume of gas flowing to the CNG fuelling station and prevent it from affecting NGN's supply to customers in Leeds. An allowance has been made in the design costs for a compressor study which will be required to ensure its operation has no detrimental effect on the upstream NGN network (see section 2 for more detail).

Item 2. HP Meter Skid

The HP meter estimate has been provided through information from initial conversations with LCC's shipper and their associated asset meter provider. The costs are based on providing a HP meter skid that is capable of being readily adaptable to a scaling load demand with limited additional cost.

Item 3. Web Portal

In line with the knowledge dissemination objectives of the project (see section 5) a dedicated web portal will be developed. This platform will provide a user focused experience with all the information required to understand the project and the CNG fuelling station's current performance. The costs for this aspect of the project have been benchmarked against NGN's successful Low Carbon Gas Preheating (LCGP) 2013 NIC bid web portal costs.

Item 4. Marketing

The commercial success of the CNG fuelling station is important both in terms of the commercial payback of the NIC funding and to provide the proof of concept evidence to help accelerate the adoption, and associated benefits, of this technology across the UK. As such a £60,000 provision has been included, based on an average of £20,000 per year, for the first three years of the project to help support knowledge transfer and provide guidance on vehicle conversion though canvassing expertise/case studies from around the globe in particular Europe.

Items 5, 6, 7 Land, RCV conversion, CNG fuelling station build

All costs associated with these aspects of the project have been provided by LCC via their work to date and soft market test information. (See appendix C).

The overall funding for the NIC submission is summarised in the table below:

Table 6: Overall funding for the NIC submission

Funding Source	Funding level/Contribution
NIC	£1,108,345.50
Northern Gas Networks	£123,149.50
LCC	£2,310,000
3rd Party Contractor	[redacted]
Total	[redacted]

Section 4: Benefits, timeliness, and partners

(a) Accelerates the development of a low carbon energy sector and/or delivers environmental benefits whilst having the potential to deliver net financial benefits to future and/or existing Customers

Reductions in emissions, and associated air quality and public health improvements

The transport sector is largely reliant on conventional, oil based fossil fuels (petrol and diesel) to power its vehicles. Leeds, alongside the rest of the UK and Europe, has seen a massive increase in the volume of diesel engines on the road due to the reduced vehicle excise duty (due to lower CO_2 emissions per km) and their greater fuel economy. This trend has had the adverse effect of worsening the country's air pollution problem.

Air pollution is a mixture of particles and gases that can have adverse effects on human health. The most significant pollutant is Particulate Matter (PM). PM can come from a range of sources and can be formed through abrasion processes, re-suspension of dusts or formed by chemical reactions in the atmosphere. Much of the PM in urban environments, particularly close to roads, can come from traffic sources due to tailpipe emissions from diesel engines. PM can cause health problems, specifically respiratory health (lungs and airway).

The gaseous pollutant Nitrogen Dioxide (NO_2) is generated by combustion. Very recently (March 2015) the Committee on the Medical Effects of Air Pollutants (for relevant excerpts, see appendix D, Evidence) gave a statement on evidence for the effects of NO_2 that strengthens the link with mortality and a range of cardiovascular and respiratory conditions, including in children.

Compressed Natural Gas (CNG), when used as a vehicle fuel, offers considerable benefits in air quality as it is virtually free of PM emissions and has a very low Nitrogen Oxide (NO_X) output (for relevant excerpts of Eurogas paper see appendix D).

On a Tank to Wheel (tailpipe) basis CNG delivers a 12% reduction in Equivalent Carbon Dioxide (CO_2e) (see appendix D, Evidence). CO_2e is a distinct measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of CO_2 as the reference.

The development of a CNG fuelling station in Leeds will enable the provision of a sustainable source of low emissions fuel, enabling users to switch away from conventional fuels with confidence that there is a steady supply available, protected from the volatile cost fluctuations seen in oil based fuels. The Department of Energy and Climate Change (DECC) have published projected price rises for fossil fuels. All scenarios show crude oil having a steeper price rise curve than natural gas. Having refuelling infrastructure is key to building industry and consumer confidence to allow first movers/early adopters to lead the way and start the trend.

At present there are no city scale CNG refuelling stations in the UK. There is a 'chicken and egg' situation in respect of encouraging first movers to take the risk to develop a station, and the early adopters vehicle market is stagnated due to the lack of fuel provision. The report produced by the University of Oxford Institute for Energy Studies comments that "the so called 'chicken and egg' syndrome hampers the development of an effective refuelling infrastructure…this refers to the unwillingness of vehicle

manufacturers/buyers to invest…". The same report observes that CNG is used as a fuel in more than 10% of vehicles on the road in nine other countries. The City CNG Project's ambition is to pioneer this technology in the UK, and in doing so produce tangible evidence that CNG works not only from an economic perspective, but from an environmental one, enabling the UK to effectively work toward bringing air pollution down to safe levels.

Should the project be a success, it will prove the business case for a city scale CNG fuelling station and will provide a project framework for replication in other UK cities.

Delivery of environmental benefits

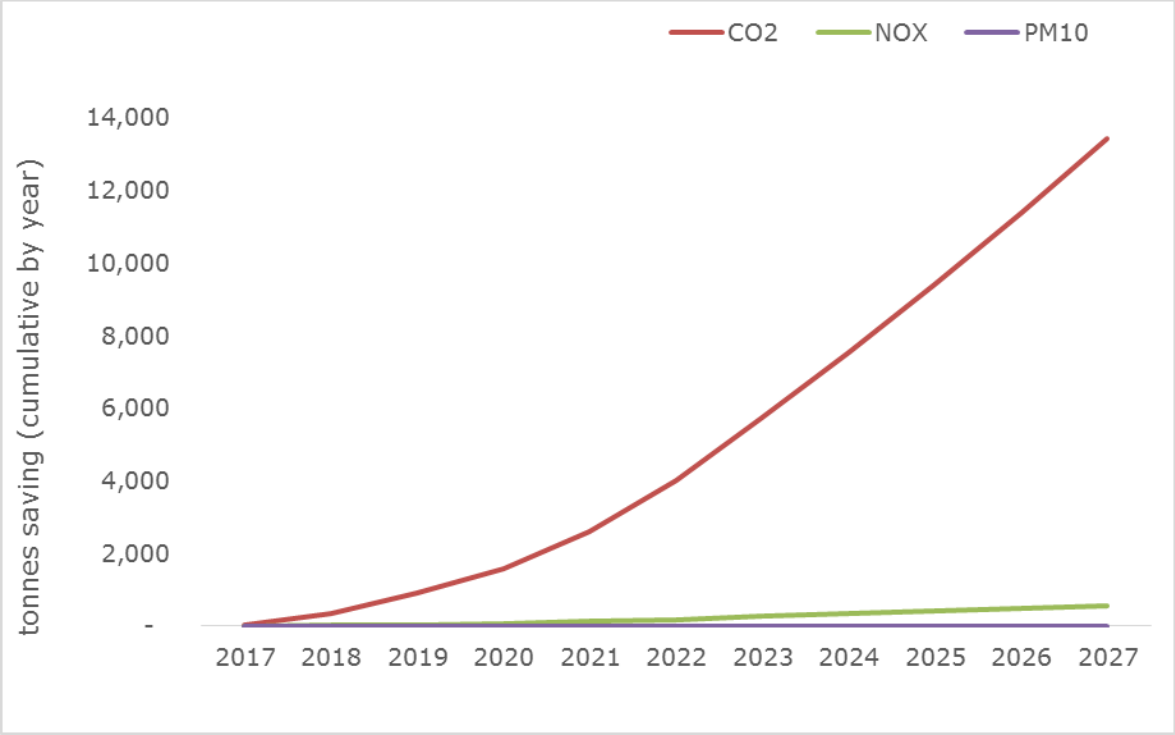
Cities are the most significant contributor to global climate change. Larger cities consume two thirds of the world's energy and create over 70% of global CO_2 emissions. Transport accounts for around 27% of the global total of energy consumption and 62% of oil consumption is within this sector (see appendix D). As of 2014, 54% of the world's population lived in cities, meaning a massive proportion of transport emissions are generated in urban environments.

As well as being key contributors to climate change, cities are also significantly affected by climate change effects, in particular by extreme weather events such as storms, flooding and heat related deaths (C40 cities, http://www.c40.org/ending-climate-change-begins-in-the-city). Due to their concentrations of people and municipal governance structures, cities have the power and influence to take action to address climate change. To positively contribute to addressing climate change, they must reduce their Green House Gas (GHG) emissions. Hence, The City CNG Project model fits the profile of a city taking positive action in this regard.

Leeds, alongside the rest of the UK and Europe, has seen exponential dieselisation of transport due to the carbon benefits and fuel economy diesel has over petrol. However, this has created another problem by worsening air quality. Diesel emits PM and NO_X which is particularly harmful to human health – there are no 'safe' levels of PM. PM contributes to 350 deaths in Leeds every year (see appendix D for excerpts from the Public Health England mortality report).

In order to understand emissions savings potential from the operation of a CNG fuelling station, throughput has been modelled over a ten year period (see appendix H, Business Model Spreadsheet). Pessimistic, realistic and optimistic scenarios have been modelled to give an indication of potential emissions savings. Please see Graph 4: Emissions Savings, which demonstrates the potential emissions savings based on a realistic scenario of conversions of vehicles and related CNG fuelling station throughput.

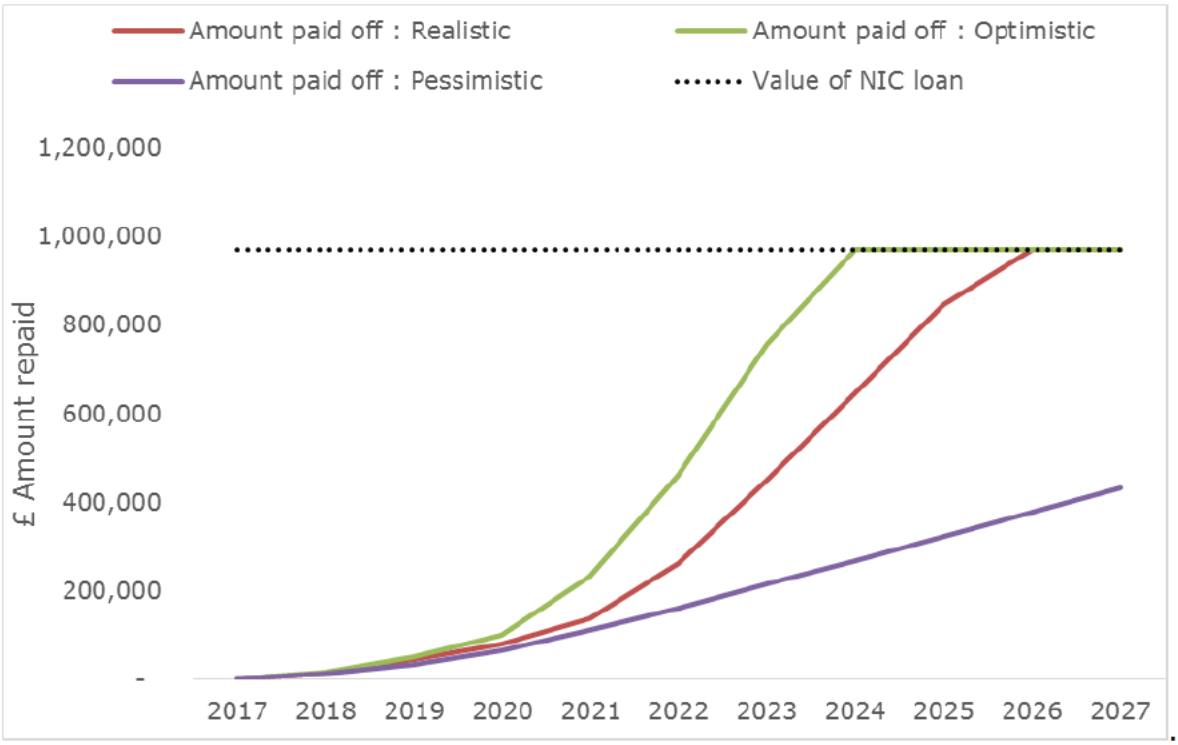
Graph 4: Emissions savings



Net financial benefits

When monetising the emissions savings in accordance with DECC and DEFRA figures the overall CBA indicates a payback for the entire City CNG Project within seven years (based on the realistic projection). Even the pessimistic projection results in a payback within 9 years. (see appendix H, Business Model Spreadsheet). Payback of the HP connection under the novel commercial arrangement is projected to be in year nine under the 'realistic model' for details see Graph 2 NIC funding repayment.

Graph 2: NIC funding repayment



Assumptions used in the business case model

Daily fuel consumption

The business model for the city CNG fuelling station is based on an assumed conversion rate of vehicles and an average CNG fuel requirement per day for those vehicles. The fuel requirements per day have been calculated using the Leeds City Council (LCC) sponsored feasibility study by JouleVert (for excerpts see appendix D, Evidence) and the assumptions listed below:

Table 7: Fuel requirements

Vehicle Type	No of vehicles	Annual Usage (ltrs Diesel)	Annual usage (Kgs CNG)	No of days vehicle in operation	CNG usage per day (Kgs)	CNG usage per day (scm)
RCVs	79	1,233,844	1,020,839	252	58.4	79.4
LCC fleet vans <3.5t	219	215,421	178,226	252	3.23	4.36
Bus: Single Decker	31	787,543	651,656	300	70.06	94.68
Bus: Double Decker	No Figures from the bus companies so assumed 20% increase on single decker					113.62
NGN vans	As per LCC <3.5t vans					4.36
NGN HGV Tanker	As per Symington's calculated value					81.96
Symington's HGVs	9	232,926	137,549	252	60.65	81.96
Other HGVs	As per Symington's calculated value					81.96

Other vans <3.5t	As per LCC <3.5t vans	4.36
Taxi	Assumed at 50% of Leeds <3.5t van – high use local journeys	2.18
Car	Assumed at 25% of Leeds <3.5t van – low use local journeys	1.09

Conversion rates of vehicles:
Conversion rates (realistic scenario) have been produced as follows:

LCC's RCVs: Based on the replacement programme from 2017 to 2022. There is a commitment from the LCC to convert all of its RCVs to CNG. (See appendix C Executive Board paper and minutes).

LCVs: <3.5t vans are a reasonable vehicle type to target for CNG conversions, of which LCC has 219. A significant proportion of these (up to 85%) would be due for replacement during the first 10 years of the CNG fuelling stations operation and are anticipated to be converted to CNG.

Buses: First Leeds have indicated to the West Yorkshire Combined Authority (the body responsible for the city's public transport) that they would be interested in converting a number of their single decker buses to CNG. Specifically those buses that are planned to operate from a park and ride site that is being built approximately 1.5 miles from where it is proposed the CNG fuelling station will be built.

Double decker buses: Based on the availability of double decker buses no conversion has been anticipated until 2023. Thereafter there will be a steady increase up to 10 within 10 years of the station being commissioned.

Taxis: In Leeds there are 530 hackney carriage taxis and over 3,700 private hires. Based on the huge volume of vehicles in operation in the city, and the running cost benefits CNG has over diesel, a number of these vehicles are likely to convert. Low rates of conversion have been used in the model for hackney carriages (50 out of 530) and private hire (60 out of 3,700). This is due to limitations in journey distances, own usage considerations for individuals and alternative funding options for taxis through the Office of Low Emission Vehicles (OLEV) including hybrid and electric cars.

Other LCVs: Starting to convert in 2021 after evidence from Leeds City Council (LCC) and NGN fleet and rising to a total of 120 within 10 years of commissioning. This is considered highly conservative noting the volume of LCVs in the Leeds area.

Symington's haulage: Have provided LCC with an email commitment stating that they would seek to convert their HGVs to CNG should there be a supply available.

Other HGVs: Commencing in 2021 after evidence from the Symington's conversion. A steady rise to nine and an additional nine within 10 years of commissioning. This is considered highly conservative noting the volume of LCVs in the Leeds area.

Private cars: Zero take up based on limitations for journey distances. However, after year 5, if other cities build CNG fuelling stations there could be potential.

The pessimistic and optimistic scenarios have been developed by the project team reducing and accelerating times and quantities of numbers of vehicles converting whilst

trying to remain realistic. In reality all these conversion rates are 'educated guesses'. The City CNG Project will provide the evidence for what the actual conversion rates prove to be.

Emissions savings

Whilst emissions savings can vary from vehicle to vehicle, for the purposes of this model the following calculations of emissions per litre of diesel burned have been used to generate emission savings outputs:

Table 8: calculations of emissions per litre of diesel burned

Vehicle	CO2 Saving per lt diesel (kgs)	NOx Saving per lt diesel (kgs)	PM Saving per lt diesel (kgs)
Council RCV's	0.77	0.040	0.000040
Council Vans	0.77	0.002	0.000014
Buses	0.77	0.016	0.000070
NGN	0.77	0.002	0.000014
Others	0.77	0.040	0.000040
Others light comm	0.77	0.002	0.000014
Taxis	0.77	0.002	0.000014
Private Car Owners	0.77	0.002	0.000014

These figures are based on advice from Joulevert (for excerpts see appendix D, Evidence)

Opex, Capex and modular growth

Prices for the build and operation of a CNG fuelling station have been supplied to LCC via the soft market test.

Monetisation of emissions

The damage costs of NO_x (£0.96/kg) and PM (£70.35/kg) have been taken from DEFRA's Air quality: economic analysis report. 'PM transport urban large' costs have been selected to be representative of an area the size of Leeds.

The non-traded cost per kg of CO_2 (£61.71 per kg) has been taken directly from DECC's Valuation of energy use and Green House Gas (GHG) emissions document.

b) Provides Value for Money for gas customers

As part of The City CNG Project there will be multiple financial and environmental customer benefits both direct and indirect. The direct benefits will arise from the following areas:

- The novel commercial agreement (see section 2 and 3 for full details). Under this agreement the majority of the NIC money will be paid back including RPI (specifically the cost of HP connection and meter skid unit).
- The reduced operational costs of NGN fleet vans (should they convert).

NGN are currently investigating the conversion of their Leeds based van fleet to CNG and will be undertaking a trial of a Liquefied Natural Gas (LNG) van in 2016 to ensure it is appropriate for the operational parameters of these vehicles on the gas network. Currently NGN's LCVs in the Leeds area have an average fuel cost per annum of circa £2,400. A conversion to CNG with an average anticipated reduction of circa 40% would provide an annual cost saving of £960 per vehicle.

This 40% cost saving has been verified via the LCC trials, JouleVert support and the following calculation:

A 50 ltr tank of diesel @ £1.20per ltr = £60.00 per tank

Equivalent kgs of CNG equates to a circa 36 kg tank @ 0.80 per kg = £28.80

Assuming an inefficiency of the CNG over a spark ignition engine of 15% (as per JouleVert advice and report)

CNG tank @ 0.80 per kg = £28.80x 1.15 = £33.12 per tank

Percentage difference = 45%

In Leeds there are around 60 vehicles that could potentially convert providing an overall Opex saving of £57,600 per annum. Under the IQI mechanism this would return 36% back to customers providing a circa £20,000 per annum return. If The City CNG Project provides the stimulus for all major cities in the UK to build similar stations this return will increase significantly. NGN will commit to converting a minimum of 15 vans in the Leeds area if the NIC bid is successful and the station is built.

The additional 'on costs' for a Mercedes sprinter (NGN equivalent) is an additional £3,200 for a one off purchase so an estimation of £2,000 additional cost for bulk purchase has been assumed. Under these assumptions the vans would recover the additional cost in about three years making the conversion economically viable provided the operational trial is successful and there would be no detrimental effect to NGN's emergency service. Reduced transportation costs for customers as a result of increased numbers of users on the grid.

The indirect benefits will come from proven health improvements in the Leeds area as a consequence of improved air quality and cheaper operating costs for public sector vehicles (RCVs, buses etc) in Leeds which could ultimately be passed onto the customer. If The City CNG Project does justify city scale CNG fuelling stations the benefits will increase exponentially.

Generates knowledge that can be shared amongst all relevant networks

The project will generate knowledge that can be shared amongst other networks in two areas:

- The novel commercial arrangement. If it transpires that this novel commercial arrangement is required for all subsequent CNG fuelling stations the contractual agreements and head of terms will be shared openly with all other networks.
- Technical complexities of the HP connection/meter unit.

To date there has been no connection to the HP UK gas network for a city based CNG fuelling station. This project will connect directly to NGN's 17bar Local Transmission System (LTS). There are several complexities associated with the design, sizing and

safety considerations of a connection to facilitate a potentially scaling CNG fuelling station. In reality the complexities relate to both the infrastructure upstream of the CNG fuelling station i.e. the HP connection and HP meter unit and also the station itself.

For the High Pressure (HP) connection and meter skid unit throughput is the major consideration as the maximum throughput demand for the station is currently unknown. This could be significant (see appendix H, Business Model Spreadsheet) if there is mass conversion of vehicles or it could be based solely on the LCC RCV truck conversion. This problem also extends to the HP meter unit which will need to be designed to accommodate a scaling station which would mean a twin stream unit whereby the meter is changed at a point in time when the original meter reaches full capacity.

Safety considerations for the HP connection will need to be taken into account during the design phase and signed off as part of the G17 design assurance process. A detailed HAZOP (Hazards through operation) will need to be undertaken incorporating a compressor study to ensure the operation of the compressor has no detrimental effect on the upstream NGN network. The compressor study will need to consider the potential of a station that is going to increase capacity over time and potentially add more on site storage and/or compression capability. As such a HAZOP may identify that the Emergency Control Valve (ECV), i.e. the valve at the 'end' of the NGN network, be remotely operable back to NGN's system control so it can be isolated in the event of a pressure drop on the LTS network.

When the project is considered as a whole, it will provide demonstrable evidence for HP connection sizing, associated metering and other downstream complexities that need to be taking into account when optimising design for CNG city based fuelling stations. By understanding the scaling profile for these stations i.e. volume conversions over time it will be possible to design optimised connections and clear connection guidelines for this type of infrastructure for use by other networks.

As part of the web portal the CNG fuelling station will be designed to provide real time data to the web platform for public review. It is anticipated that this data will show the following which can be used for all subsequent city based CNG fuelling station connections. All data would be represented daily, weekly, monthly and yearly:

- Throughput at the meter point – throughput at the billing meter point for the station.
- Throughput at the pump – noting there will be storage on site this will demonstrate the difference between the time gas is taken from the network and the time it is used at the station i.e. when vehicles fill up.

This information will be critical to future optimised sizing of HP network connections and CNG fuelling stations. It will also provide evidence which may support timeslot refuelling contracts with large providers. This will enable a flat profile of use to be established for optimum station efficiency and minimum vehicle waiting times at the station forecourts. It may also be used to mitigate any capacity risk associated with gas networks by, for example, ensuring Refuse Collection Vehicles (RCVs) do not all fill up at peak gas daily demand times if that would cause a capacity issue on a network.

d) Is innovative (not BAU) and has an unproven business case where the innovation risk warrants a limited development or demonstration project to demonstrate its effectiveness

The commercial agreement under which it is proposed the HP connection is funded is unproven and has never been tried before. The risk being taken we believe is small relative to the environmental benefits for customers. We do not know whether such agreements will be necessary for any future CNG stations.

The Leeds CNG fuelling station will be the first CNG fuelling station to connect to the Local Transmission System (LTS), HP main in the UK. There are some smaller, purpose built stations dotted around the country connected to medium pressure mains, however, these were not designed for modular growth. The Leeds CNG fuelling station will be the first of its kind in the UK, built to support large scale conversions away from diesel and petroleum, designed to allow for expansion to meet the needs of a growing customer base.

e) Involvement of other partners and external funding

LCC worked in partnership with Cenex to trial a full biomethane RCV and a dual fuel RCV in 2009. More details of the trial can be found in the Cenex report (for excerpts of the Cenex report see appendix D). This led to LCC applying for DEFRA funding for a small, permanent LNG refuelling installation, and bringing five gas RCVs on to the fleet on a permanent basis and a number of small caddy vans.

Due to the fuel cost savings and environmental benefits, there has been a will to find a sustainable solution to expanding the use of gas in the LCC fleet. Soft market testing revealed that a significant barrier to the private sector investing in/developing a CNG fuelling station project is the cost of the connection to the gas main. The private sector is willing to invest in the build/operation of a station, however it has been indicated that the cost of connection to a gas main would make a venture too risky for them to embark on, unless there was an established customer base to support the business case.

LCC have utilised the Local Transport Plan funding to commission a CNG consultant (Joulevert) to undertake a CNG feasibility study to assess the appetite for local businesses to adopt CNG as a fuel should a supply become available, and for a cost analysis of a CNG project (for excerpts of the Joulevert report see appendix C)

Should the NIC bid be a success, LCC shall conduct a competitive process to select a private operator to work in partnership with to build and operate the station as a sole investor or in a joint venture arrangement.

LCC have been selected as a partner due to them being the municipal authority with delegated responsibility from central Government to lead the way in addressing the city's air quality problem and reduce carbon emissions. LCC are also in a position to provide the anchor load of RCVs needed to kick start the station project.

It is essential to appoint a 3rd Party Contractor to ensure the right skills and expertise are brought in to design, build and operate the station as it is not the LCC's, or NGN's core business to run refuelling facilities.

f) Relevance and timing

NO_2 and PM, together with other air pollutants, have been set upper exposure limits in order to protect public health which are legally binding through EU and UK law. There is an urgent need for the UK to take action to improve air quality across all cities as public

health impacts from pollution are significant (for excerpts from the Public Health Document see appendix D). The Government's plans to improve air quality in order to meet 2010 targets set by the EU were dismissed as insufficient and quashed by the Supreme Court in April 2015. The court ruled on the basis that plans would not achieve legal limits in some British cities until after 2030. Client Earth (an environmental pressure group) took the case to the Supreme Court on the basis of the Government's failure to plan effectively and to further demand that the EU then expedite the case against the UK Government and press for fines for failure to meet obligations. Client Earth's case concerned 16 cities and regions (including Leeds), with Leeds, London and Manchester being repeatedly referred to in national press coverage of this ruling. The urban areas of West Yorkshire have been identified as having some of highest levels of air pollution in the UK, with only London showing higher levels at a regional level.

Continued failure to meet the limit values will put the UK Government at risk of legal action being taken against it under European law, with the further risk of any fines imposed on the UK Government being passed down to local authorities if their action, or inaction, has contributed to the limit value being exceeded. DEFRA recently wrote to all local authorities seeking their co-operation in achieving compliance with the air quality limit values, adding: "we feel we ought to remind you of the discretionary powers in Part 2 of the Localism Act under which the Government could require responsible authorities to pay all or part of an infraction fine". Given that the West Yorkshire zone is not predicted to achieve compliance with the limit value for NO_2 until after 2030, there is an urgent need to ensure that responsible local authorities are doing all that they can to achieve compliance with the limit value in the shortest possible time.

Further, the Climate Change Act 2008 makes it the duty of the Secretary of State to ensure that the net UK carbon account for all Green House Gases (GHG) for the year 2050 is at least 80% lower than the 1990 baseline, to contribute effectively toward avoiding dangerous climate change. Transport plays a significant role in the level of GHG emissions from cities (see section 4.1).

In light of the above, a step change in thinking towards decarbonisation of transport and air quality is required in the UK. The City CNG Project will enable the establishment of a CNG fuelling station built for city scale conversion to act as a proof of concept catalyst for this technology. Furthermore, against the ultimate objective of decarbonising transport and improving air quality, accelerating the CNG market to support a move towards CNG vehicles on a larger scale will begin to shift the heart and minds of UK public and industry on the use of gas fuelled vehicles. This will prepare a platform should there be a shift towards the ultimate goal of a hydrogen economy.

Finally it is worth noting that this project does not purport to favour gas over electric fuelled vehicles, rather the two together can supplement the overall UK emissions ambition. As concluded in the Oxford Institutes for Energy Studies in March 2014 (p41) "if a fully (or even significantly partly) decarbonised electricity supply was in prospect within a reasonable timescale then a full commitment by policy makers to electric vehicles may have some merit. However given the uncertainties around biogas and the future power generation mix it could be argued that Governments should adopt a more nuanced approach in order to avoid being stuck in a technological blind alley".

Section 5: Knowledge dissemination

5.1. Learning generated

Role of Data, Knowledge and Learning Dissemination

Effective knowledge dissemination is central to the project achieving its aims and objectives. There is a wide range of stakeholders for whom the data, knowledge and learning generated from this project would have both direct benefits and impact on key aspects of their businesses and operations. It is therefore important that each of these individual stakeholders and groups be clearly identified and that a specific knowledge and learning dissemination plan be developed. At this stage the following stakeholder groups will be included within the plan.

- Gas Distribution Networks.
- Ofgem.
- Local Authorities.
- DECC/DEFRA/DfT.
- Fleet Operators and Local Businesses.
- Fuel Station Owners/Operators.
- Financial Investors.
- Gas Shippers and Suppliers.
- Local Residents.
- CNG Vehicle manufactures and trade association.
- Relevant government departments.
- Natural Gas Vehicle (NGV) manufactures and trade representation.
- Local Enterprise Partnerships (LEP).
- Core Cities network.

Effective engagement with some of these groups has been a key element of the preparatory research and development work already undertaken and referenced within this document (e.g. LCC, fuel station operators). As such, real routes of communication have already been established and initial knowledge and learning shared. This project will look to build directly on these and extend across the wider stakeholder group.

Engagement with these groups has identified that the absence of high quality data and knowledge drawn from application in a real environment is the key blocker to private investment in this area. This project and the knowledge it derives will act as the key stimulant to future development of these technologies and the market for the associated products and services of CNG being used as an alternative vehicle fuel.

To manage this complex and wide ranging group of stakeholders and recognising its importance in delivering the overall project objectives, the project will have a separate work stream focussing on this task. The learning dissemination will focus on both internal and external learning and knowledge dissemination activities and inform our marketing strategy.

Categories of Data, Knowledge and Learning

There are several key categories that will be derived from the project from a variety of sources:

Proof of Concept: A greater understanding of the role of a commercially viable model for the delivery of secure sources of CNG as a fuel for transport within a city region will assist directly in identifying the policy options available to address environmental issues

associated with transport, thus resolving the 'chicken and egg' scenario described in sections 3 and 4.

Commercial: One of the key elements of this proposal is to understand the potential for amendments to current network connection charging arrangements that may better facilitate the development of low carbon technologies, and initiatives longer term. The development of the regulatory and commercial framework to support the development of the entry of unconventional sources of gas into the distribution network over recent years illustrates the challenges that can exist e.g. Biomethane. This project will establish the necessity, or otherwise, of offering new commercial arrangements for High Pressure (HP) connections to Compressed Natural Gas (CNG) fuelling stations, whereby the repayment for the HP connection will be recovered (including RPI) based on throughput over a 10 year period, with any outstanding sums owing after that period potentially being written off. Conversely, the project may prove that stations can be a stand-alone success without the need for a commercial arrangement which will also facilitate the onset of investment in the CNG refuelling industry.

Technical: The design, sizing and build of the HP connection will educate the UK gas industry on the technical parameters associated with the optimising of a HP connection to facilitate an unknown growth profile of the CNG market. Capacity and throughput data will inform how such facilities will impact upon the efficient operation of the distribution network.

There are several areas of technical knowledge that it will be important to disseminate and share effectively including capacity and usage data, both within day and across longer periods. This would help inform the size of connection required to deliver optimal investment decisions and reduce costs of entry.

5.2. Learning dissemination

Key responsibilities for knowledge dissemination and learning

Partners within the project will have a role and contribute to the dissemination of knowledge and learning from the project. However, the Project Team will be responsible for delivering the data, knowledge and learning Strategy developed at the start of the project. This strategy will develop a set of overarching aims and objectives for the project and identify the necessary work streams with a responsible owner and an associated project plan and timetable for each.

Methods of Dissemination

The wide range of stakeholders in the output from the project dictates that our dissemination strategy must include a diverse range of methods that should be adaptable to the requirements of each particular audience.

Project Web Portal: NGN will create an easily accessible web portal linked directly from its home page (and ENA portal as per NIC governance) and will form the hub of all its disseminated knowledge. This will document the performance of the CNG fuelling station, lessons learnt, case studies for vehicle conversion and ultimately providing the evidence for the business case associated with city based CNG fuelling stations shall be developed to assist in the roll out of this learning to all relevant stakeholders.

Conferences and Seminars:

- Attendance at the NIC annual conference to update on progress and lessons learnt.
- IGEM Annual Engineering Update Conference to share analysis of the data and update engineering community.
- Network and local events; site visits and presentations given to interested stakeholders.
- Publications: Specific areas for wider communications including gas and utility industry journals and periodicals to ensure maximum coverage of the benefits of the whole project and some of the key lessons learnt in collaboration with the Marketing work stream of the project.
- Video, Podcasts, Social Media: To increase the dissemination to a wider audience NGN will consider the use of video updates on YouTube and use our social media mechanisms (LinkedIn) to put out overviews of the project to other stakeholders.
- Consider how we interact with car manufactures, DECC, DEFRA, DoT, Core Cities, Other Local Enterprise Partnerships (LEP), NGV, etc.

5.3 Intellectual Property Rights (IPR)

This project will conform to the NIC default IPR arrangements and a memorandum of understanding will be signed with all vendors and each project partner.

Section 6: Project Readiness

6.1 Evidence of why the Project can start in a timely manner

NGN and Leeds City Council (LCC) have already spent a significant amount of time considering the commercial and technical practicalities of this project to ensure delivery in line with the SDRCs in section 9. LCC have undertaken trials in this area since 2009 to ensure suitability of gas as a vehicle fuel has been rigorously tested, to engender executive level support for conversion of the anchor load (Refuse Collection Vehicles (RCV)) for the CNG fuelling station. Potential economic and environmental benefits of a Compressed Natural Gas (CNG) fuelling station can be evidenced around the globe and in several academic papers (see appendix D, Evidence). The technology is at the correct Technology Readiness Level (TRL) to be built (7-8), but the challenge is understanding the UK market's appetite for CNG city scale conversion i.e. does the economic business case stand up?

Leeds City Council (LCC) commitment:
As detailed in section 2 to date LCC have completed a number of trials and market testing to ascertain the benefits of CNG as a vehicle fuel for its RCV fleet (see section 2 for full details). The trials and soft market tests have provided enough justification for LCC to demonstrate that a city based CNG fuelling station would have significant cost and environmental benefits for the city. However, the RCV fleet alone cannot justify the high upfront costs of the CNG fuelling station and associated High Pressure (HP) connection.

To establish the private sector appetite to provide the funds for the build of the CNG fuelling station LCC has undertaken two rounds of soft market testing, the most recent being in Spring 2015. Excerpts of the pro-forma applicants were invited to complete can be found in appendix D, Evidence. The Pro-forma laid out LCC's key objectives in respect of CNG infrastructure requirements, as such, the marketplace is aware of LCC's intent to initiate a competitive process and are poised to develop bids according to the published tender documentation. In the second soft market test which removed the requirement to fund the HP connection half of the companies indicated they would be prepared to supply the investment.

The work undertaken to date has allowed LCC officers to prepare a report for their Executive Board which is the principal decision making body of the Council (see appendix B). The Board is chaired by the Leader of Council and comprises eight Executive Members. The paper which was tabled at the 15 July 2015 meeting requested members to approve the following recommendations:

- To support LCC's involvement in the NIC bid.
- To approve the injection of £1.58 million into the Capital Programme to be fully funded by unsupported borrowing, to convert to Refuse Collection Vehicles (RCV) (see appendix C, LCC Governance).
- To authorise delegated powers to the Director of Environment and Housing to enter into the contractual arrangements with NGN for the delivery of a gas main connection.
- To support in principle the decision to enter into arrangements with a private sector partner to deliver a CNG fuelling station, anticipated to be a joint venture.

The relevant excerpts of the minutes of the meeting showing approvals can be found in appendix C, LCC Governance.

Should the bid to the NIC be a success, the engagement of a 3rd Party Contractor to design and operate the station shall be led by LCC's Projects, Programmes and Procurements Unit. This is a specialist unit comprising Project Management, Procurement, Legal and Commercial professionals with vast experience of delivering unique and innovative products and contracts. Staff within the Unit have been heavily involved in the development of the NIC bid, therefore the background knowledge and understanding of the requirements are already embedded within the team so they are primed to mobilise the project.

The successful delivery of a CNG fuelling station directly contributes to LCC's: 'Low Carbon Breakthrough' programme, which is committed to making low carbon Leeds a reality by planning for a more sustainable future. Currently the city has a target of reducing carbon emissions 40% by 2021, and transferring all 1,200 of its fleet to alternative fuels by 2025. It will also make a significant contribution to the reduction of harmful emissions from the LCC's fleet of vehicles and will therefore also support delivery of air quality improvements and establishing a green transport infrastructure.

The geography in which it is intended to build the CNG fuelling station is a 'hub' of green activity. Within a 1 mile radius there is the Yorkshire Water wind turbine that stands 123 meters tall and is capable of generating the equivalent of the energy needs for well over 1,000 homes. Yorkshire Water also have plans in the pipeline to develop an anaerobic digestion facility on the site directly adjacent to the intended site of the CNG fuelling station. The Leeds Recycling and Energy Recovery Facility (RERF) is currently under construction and will open in summer 2016. The facility is expected to generate 11 megawatts of electricity, enough to power 20,000 homes, which will be fed into the National Grid through the combustion of around half the city's black bin waste. This opens up the possibility of multiplying the benefits of the station through use of green gas. The area has been specifically chosen as it will result in the most efficient implementation of the programme to maximise benefits by being in the same area as the Refuse Collection Vehicle (RCVs) use for tipping.

HP connection – Project readiness

The HP connection element of The City CNG Project would be managed through NGN's Major Projects department and would be subject to the Integrated Management Systems (IMS) in place within this team. The Major Projects team's IMS is integrated with the ISO9001 quality system. It sets out the process and procedures to follow for the implementation of a project through the design and delivery phases.

The Major Projects team is a multi-disciplined team with significant, relevant experience in HP project delivery. To date they have been involved with this NIC bid at all stages including providing the quotation for the HP connection following site surveys of the various land options. Within NGN there are already well established frameworks including experienced design and build contractors who, via a competitive tender process, will be used to deliver the detailed work.

Project Programming

For all Major Projects, cost loaded programmes are prepared in Primavera P6 (Please see appendix E, for details of our programme). The project programme has been developed

taking into account the interrelationship between all key stakeholders i.e. NGN, LCC and the 3rd party contractor. The timetabling has been built on realistic forecasts of how long each element is likely to take incorporating realistic amounts of schedule contingency to ensure timely delivery of the project in line with the SDRC's. The HP connection has been scheduled and costed based on a typical HP connection with a contingency allowed for the technical complexities described throughout this document.

6.2 Evidence of how the costs and benefits have been estimated (this can be supplemented in the appendices)

The costs identified in the business case are further supported in appendix A. All costs associated with funds provided via the NIC have been established via the Major Projects team, discussions with the LCC HP meter provider and benchmarking costs against NGN's successful 2013 NIC bid Low Carbon Gas Pre-heating Project (LCGP).

Costs for the non NIC funded elements of the project have been provided via LCC.

Projected benefits associated with The City CNG Project have been provided in appendix H Business Model Spreadsheet. The information has been developed based on modelling pessimistic, realistic and optimistic scenarios for vehicle fleet upgrades to CNG fuel. The realistic scenario has been based on tangible evidence and discussions with independent operators via LCC and all assumptions behind these scenarios can be found in section 4. It is worth noting that these projections are still considered conservative for all scenarios. This is because they are based on evidence from a limited number of organisations. In reality there are far more organisations within the Leeds area that are yet to be contacted which have the potential to use the CNG fuelling station as a viable alternative for their current diesel fleet.

The tables and graphs produced from the three scenarios of conversion (pessimistic, realistic, and optimistic) are based on a range of assumptions which are detailed in section 4.

6.3 Evidence of the measures a Network Licensee will employ to minimise the possibility of cost overruns or shortfalls in Direct Benefits

The project will organise a risk and opportunity workshop with the objective of creating a risk and opportunity register which will list any significant cost and schedule risks that may impact the successful delivery of the project as well as identifying possible cost and schedule saving opportunities.

Project progress review/governance

Once the project becomes live, it will be managed closely against the delivery milestones in the project plan (see appendix E) whilst ensuring commercial and engineering quality assurance Project Partners (i.e. design and build contractors associated with the HP connection) are engaged under Option A lump sum contracts.

Before a contract is awarded the expenditure and scope of work will be approved by NGN's sanctioning committee, the Investment Steering Group (ISG). The ISG is made up of NGN senior management. This group has already reviewed this project, evidence of which can be found in appendix E in EXP01 form which is one of the IMS requirements.

The signatures on this form also demonstrate the project readiness and support of senior management within NGN.

If the NIC is awarded, a project specific City CNG Steering Group will be set up to meet on a regular basis. The City CNG Investment Steering Group will review progress against the programme and costs against the budget, as well as support with removing barriers to delivery and management of delivery risk.

To close the project a report will be produced and published in line with the information contained within section 9.

6.4 A verification of all information included in the proposal (the processes a Network Licensee has in place to ensure the accuracy of information can be detailed in the appendices).

Data assurance activities have been performed to ensure the accuracy of the data provided in this submission in compliance with the requirements of Ofgem's Data Assurance Guidance document under Standard Special Condition A55: Data Assurance of NGN's Gas Transporter Licence.

Please refer to the separate NIC Bid 2015 Irregular Submissions template document which provides details of the DAG Risk Assessment performed and the detailed data assurance activities performed to comply with the DAG.

Figures contained in appendix A have been produced by the Major Projects team in conjunction with the Project Partners for their specific elements of work. All other figures have been provided and verified by LCC and/or their consultants JouleVert.

Regular internal meetings have been held within NGN in the preparation of this bid to ensure that the objectives proposed are achievable. Appendix E contains our EXP01 form signed by four senior managers to demonstrate that the bid has the full backing of NGN.

6.5 How the project plan would still deliver learning in the event that the take up of low carbon technologies and renewable energy in the Trial area is lower than anticipated in the Full Submission.

Due to the absence of large scale CNG fuelling stations within the UK there is limited opportunity for depot based city vehicles to convert to CNG. This is prohibiting the opportunity for significant reductions in operating costs, emissions and associated air quality and public health improvement. CNG offers the opportunity for a vehicle fuel that is cheaper, less volatile to price fluctuations (than diesel/petrol) as per DECC's projected price rises for fossil fuels and with proven reductions in Particular Mater (PM), Nitrogen Oxide (NO_X) and carbon emissions.

The City CNG Project has three core objectives, the learning associated with each objective in the event that the take up of low carbon technologies and renewable energy is lower than anticipated is as follows:

Key objectives:

Objective One: The project will act as a 'build it and they will come' proof of concept for UK cities with the ambition of providing the business case for private sector investment in large scale city based CNG fuelling stations.

Fundamentally this element of the project is to provide the learning for UK cities concerning the viability of city based CNG fuelling stations. Effectively it will provide the evidence that is currently lacking within the UK for this type of station irrespective of how much or how little the take up of vehicle conversions aligns to the projections within this submission.

Objective Two: The project will explore a novel commercial arrangement for providing HP connections to CNG fuelling stations.

The novel commercial arrangement that is adopted as part of this project will be potentially transferable to other 'new technologies' and/or connections processes provided a business case exists for its implementation. The development of the commercial arrangement, documents and evidence of its operation could potentially be utilised by other networks or other applications.

Objective Three: The project will identify appropriate technical complexities for sizing, design and build of HP connections associated with this type of infrastructure.

The design parameters and considerations (for example the use of a remote operable valve on the network extremity) that need to be undertaken as part of a connection to a city CNG fuelling station will be transferable and made available to the rest of the industry through our innovative web portal. The take up of CNG vehicles over time will provide a profile for connections to enable optimised connection sizing and development of a standard functional specification around other technical parameters for example telemetry.

In addition to the above, the project will also provide demonstrable case studies on fleet conversions which can be used openly to the benefit of other UK cities and UK plc as a whole.

6.5 The processes in place to identify circumstances where the most appropriate course of action will be to suspend the Project, pending permission from Ofgem that it can be halted.

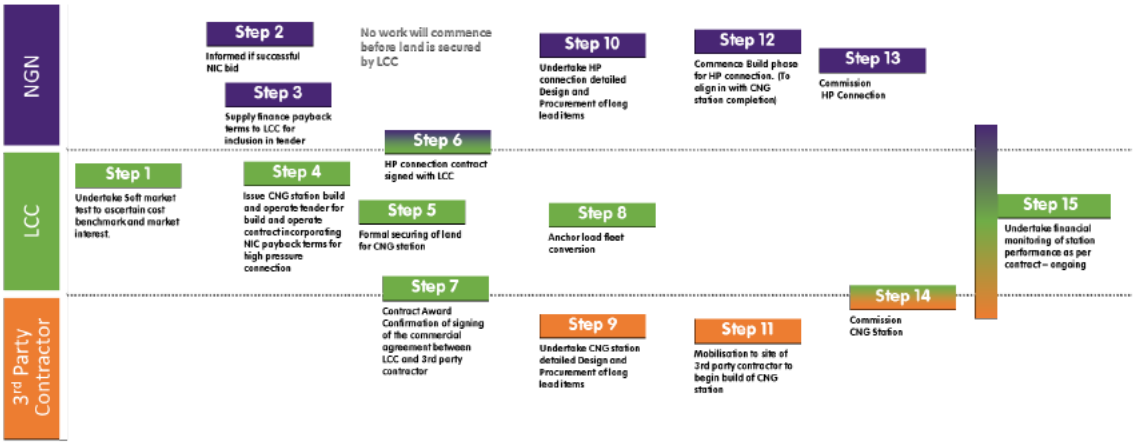
A critical role of The City CNG Steering Group will be to support the Project Lead in assessing the project against the evaluation criteria in section 9. If at any point it is apparent that the project is consistently failing to achieve the evaluation criteria then The City CNG Steering Group can ensure consultation with Ofgem to request halting the project.

The City CNG project has been carefully designed to provide a 'full picture' in incremental steps. This allows the project to be terminated at specific points in time whilst still providing credible and beneficial learning to the UK gas and transport industries. Due to the significant involvement of external parties (LCC and 3rd Party Contractor) specific milestones have been included against the HP connection element of the project in order to mitigate the identified risks described in section 2. These are detailed in section 2 but are summarised in Table 9: Contract milestone activity below:

Table 9: Contract milestone activity

No	LCC Activity milestone	NGN Activity
1	Formal securing of land for CNG fuelling station	No work will commence before land is secured by LCC
2a	Signing of the connection agreement by LCC	NGN start HP Connection design process
2b	Confirmation of signing of the commercial agreement between LCC and 3rd Party Contractor	
3	Confirmation of procurement of long lead items for CNG fuelling station build (e.g. compressors) by 3rd party contractor.	NGN start procurement of Long lead HP connection materials (e.g. fittings / pipe)
4	Mobilisation to site of 3rd Party Contractor to begin build of CNG fuelling station	NGN begin build of HP connection.

Table 10: Contractual sequence of milestone activities



It is anticipated that The City CNG Steering Group will formally sign off completion of each LCC activity milestone prior to NGN activity progressing. Should The City CNG Steering Group consider that these milestones are being delayed or in jeopardy of not completing the Steering Group will consider halting the project and consult accordingly.

Other than the risk associated with external partners' work, execution against the HP connection would be undertaken in line with the Major Projects IMS and internal NGN governance. The project would continue to completion unless it became clear that the outputs, costs or programme were at risk. If this were the case the project would be re-evaluated and a decision made (pending permission from Ofgem) as to whether completing the project was in the best interests of the UK gas industry and its customers.

NGN have a highly experienced, mature project delivery capability and coupled with the detailed due diligence the network has undertaken on the construction of this bid the above is considered highly unlikely.

Section 7: Regulatory issues

It is widely recognised that to maintain affordability the gas distribution network has a role in facilitating the development of a low carbon economy. To fulfil this potential it is necessary to challenge and understand more fully the role that current operating, regulatory and commercial arrangements may have in acting as barriers to entry in energy markets. It is important to appreciate that current arrangements are based primarily on a stable and relatively mature customer base and will not have considered explicitly the requirements of new technologies. The development of the regulatory and commercial framework to support development for the entry of unconventional sources of gas into the distribution network over recent years illustrates the challenges that can exist.

One of the key elements of this proposal is to understand the potential for amendments to current network connection charging arrangements that may better facilitate the development of environmentally beneficial and/or low carbon technologies and initiatives longer term.

This proposal is based upon the construction of a High Pressure (HP) connection under a novel commercial arrangement with the owner/operator of a CNG fuelling station. This arrangement will allow for payments for the cost of this connection to be spread over a longer duration than under current arrangements and to be linked directly to the performance of the fuelling station. For the purposes of this project, if the station achieves the agreed performance criteria, then the cost of connection will be fully recovered, however, should the station not be successful then part of the cost of connection may be written off. (The precise details of these arrangements will be finalised as part of the NIC project.) This strikes a reasonable balance between releasing the potential entry barriers that a 'deep connection' charging policy may imply for a developing, low carbon technology whilst ensuring customers gain full economic value from a successful project.

To implement this arrangement potentially requires a derogation to NGN's Gas Transporters Licence to support a) the delivery of deferred payment terms and b) under the worst case assumption, the potential for the cost of connection never to be fully recovered. It is worth stipulating from the outset that the intent of the agreement will be to fully recover these costs.

Standard licence condition 4B defines in paragraph 5 the relevant objectives for gas distribution connection charging which would be applicable to such charges. The general principles about cost reflectivity etc. could be said to only apply to the level of charges levied in respect of the connection. However, we are assuming that Ofgem would interpret this more widely so that it applies not only to the level of charges but also to how we then take payment of them. Our normal terms of payment would require the full costs of the connection to be paid before the connection is fully commissioned and would not contain a potential write off provision so our primary concern is that this would be considered as providing undue preference or discrimination. For the avoidance of doubt the level of the connection charge will be calculated in full compliance with the licence requirement and the charging methodology statement - there will be no discounting or differentiation in the charging methodology for this connection compared to any other HP connection.

Our reading of the relevant obligations is that under section 9 (2) of the Gas Act there is general duty to avoid any undue preference or discrimination in the connection of premises or pipeline systems. Standard Licence Condition 4B paragraph 5 (a) links the objectives of charging methodology directly to requirements under the Act. Therefore the primary consideration is whether the terms we are offering for this particular connection constitute undue preference or discrimination. It would be the first occasion we have ever connected such a fuelling station to our HP system therefore there is no previous comparable connection, nor have we ever been asked to previously quote for connecting a fuelling station of this nature. As this is a first we cannot determine at this time whether we would or would not offer similar terms to any similar fuelling station looking to connect at some future point. Indeed the success or failure of the NIC project itself will help determine this but we can state it is not our intention to offer the terms that might be developed in this instance to the broader range of connections customer.

Following consideration by NGN of its licence responsibilities and discussion with Ofgem it is not considered a derogation is required for the connection agreement for the station.

Section 8: Customer Impact

Direct Customer Impacts

The project will not require any direct impact on any existing customers' premises or any interruption to gas supplies. The project does not require any customer disconnections or interruptions during installation or operation of new equipment. Safety and security of supply will have the highest priority throughout the whole of this project with existing safety precautions being maintained or improved during every operational change or engineering operation.

Risk of Interruption

There is always a small risk of unplanned customer interruptions when carrying out work on the network due to unforeseen circumstances, however, the risk of such an occurrence happening is extremely low. The project will require a new connection to NGN High Pressure (HP) network. However, the nature of the works required to deliver this project do not present any additional specific engineering or operational challenges that do not already exist in any other HP connection to NGN's network. NGN will employ the same project management, resources and technical skills employed in delivering all other major engineering projects that underpin our delivery of projects to the highest standards of safety, efficiency, reliability and customer service.

Stakeholders in the trial area

It is considered that the risks associated with carrying out activities directly upon the networks will be managed to ensure that they are no greater than exist under business as usual processes. Consequently we do not see any requirement for alterations to our existing stakeholder strategy in this area. Indeed we will be targeting local businesses in the area to convert to CNG and gain benefit from the station directly.

Section 9: Successful Delivery Reward Criteria (SDRCs)

9.1 Novel Commercial Arrangement

Agreement and formal sign on to the novel commercial arrangement required to recover the NIC funds associated with the High Pressure (HP) connection and metering unit. June 2016

9.2 Design of HP pipeline

As described in section two of the City CNG submission the design of the HP pipeline will commence after LCC have:

- Confirmed the land for the CNG site.
- Signed off contracts with their 3rd Party Contractor.
- Signed NGN's connection agreement (including the novel commercial arrangement).

Following achievement of these milestones the design of the HP connection pipeline will be completed within six months.

9.3 Build of HP connection pipeline

As described in section two of the City CNG submission the build of the HP pipeline will commence once the 3rd Party Contractor has mobilised to site or NGN have written confirmation the build is to proceed including start dates.

Once this has been achieved the HP pipeline build will be completed within seven months.

9.4 Functioning station

The station will be designed to correctly integrate with NGNs HP pipeline and meter skid, with storage and compression capacity to serve the outline customer base as modelled in the 'realistic' scenario. The station shall open 'on-time' at a date agreed during their appointment and be ready to serve customers on day one. All equipment shall be fully operational, and staff fully trained to operate and assist customers.

9.5 Vehicle usage is in line with estimate

The projections made in the 'realistic' business model scenario are met or exceeded.

9.6 Knowledge, Learning and Dissemination Strategy (a)

Deliver project web portal, accessible by all interested parties

- Web portal procured – December 2016.
- Data on web portal to include progress reports, and any relevant case studies, designs etc. from the work undertaken to date.

09.7 Knowledge, Learning and Dissemination Strategy (b)

Information from the CNG fuelling station to be available on the web portal within three months of station commissioning, this is intended to include:

- Daily usage at the gas meter.
- Daily usage at the pump.

9.8 Project Evaluation and final report.

The novel commercial arrangement for the project will continue for a ten year period from station commissioning. However a final report will be produced two years after station commissioning which is currently anticipated to be October 2019. This report will act as the end of the NIC project. However the web portal and commercial operation will continue as described in the submission.