Department for Transport

Project BREATHE 3

(**B**us **RE**trofit: **AT**tenuating **H**armful **E**missions)

A partnership bid to the Clean Bus Technology Fund
from Leicester City Council and Leicestershire County Council

Centrebus Route 40 & 162:

OUTER CIRCLE via General Hospital - Oadby - Fosse Park - Thorpe Astley Glenfield - Beaumont Leys - Hamilton - General Hospital
LEICESTER CITY CENTRE via Hinckley Road - New Parks - Tatlow Road

October 2015

Department for Transport

Application Form for Clean Bus Technology Fund 2015

The Department for Transport (DfT) is inviting local authorities in England[1] to apply for Clean Bus Technology grants of a maximum of £500,000[2] towards reducing oxides of nitrogen (NOx) emissions from local buses. The total fund available for this scheme is £5m.

Applicants should use this form to submit their proposals to DfT by 17:00, Friday 30 October 2015. Applicants can propose to upgrade vehicles with more than one type of technology but should use one application form per technology. Guidance notes have been published to assist you with completing the application form.

All applicants must confirm that they have secured appropriate interest from at least one operator that will engage in the proposed project. Please check the box below to show that you have completed this requirement.

I have secured commitment as stated above:

In addition, all applicants must confirm that they have received legal advice on EU state aid rules and that the proposed project is compatible with the relevant restrictions. Please check the box below to show that you have completed this requirement and provide a short summary of the legal advice you have received which explains why the proposed project would either not be classed as state aid or would be classed as compatible aid which is exempt from the requirement to notify the European Commission in advance of proceeding.

I confirm that I have received legal advice on EU state aid rules which will allow the proposed project to proceed if successful:

Mark Wills

[1] In London, the Greater London Authority (GLA) is invited to coordinate and apply on behalf of London boroughs as a single bid for no more than £500,000.

[2] Authorities can only bid once for a Clean Bus Technology grant of up to £500,000.

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Summary of legal advice received:

State Aid – Summary of our legal advice

Introduction
The City Council is under a number of statutory requirements to work towards achieving cleaner air; as part of the State's response to achieving the improvement of Air Quality pursuant to the EU Directive on Air Quality. Further; the current general power of competence (s1 Localism Act 2011) includes provision for its exercise for the economic, social and environmental well-being of an authority's area.

The Clean Bus Technology bidding opportunity required the City Council to consider whether this grant would constitute State aid. Legal Services have advised project officers concerning this question and, in summary, based on the information provided during the preparation of the bid and in the submission, the grant to the bus company will not constitute State aid provided certain safeguards are built into the terms of the grant. These are already prefigured though discussions with the bus operators and in the following terms upon which the grant is available to the City Council:

i) That the equipment to be fitted should be such as is approved by the Council in order to achieve specified air quality criteria (set out in the grant).

ii) That fitted buses should continue to operate for five years on the City's routes.

iii) That in the event they are not the grant should be repayable pro-rata together with any additional value in the buses arising from the improvement.

iv) That any contributions to increased operating costs cease if the buses cease to be used in the City during project period.

v) That there be open book provisions to enable adjustment of the grant if the financial case changes.

vi) That the buses be open to inspection to ensure that purposes of the grant are being adhered to.

And, if it is found to be State aid, (following a determination by a court) that the grant be repayable.

To constitute State aid, the relevant EU rules require that all four questions below have to be answered as: ‘Yes’. In this case, only one question answers

as ‘yes’ and therefore we are content that this proposal does not constitute State aid within the meaning of the Treaty.

1. Is the assistance granted by the state or through state resources?
‘Yes’ in terms of both DfT and LCC involvement. It should be noted that there are circumstances where government interventions are necessary for a well-functioning and equitable economy. There are ‘horizontal rules’ aimed at solving problems that may arise in any industry and country. This project aims to reduce air pollution from traffic and its related illnesses; as well as helping to reduce traffic related carbon emissions. This project may also come under one of these other categories.

2. Does the assistance give a selective advantage to one or more undertakings over others?
‘No’. Lower vehicle emission levels are not a direct driver to increased bus patronage. The Council will provide revenue support, up to a maximum level over the five year project period; with the intention of only covering additional, project related operating costs incurred by Centrebus. We can anticipate extra costs of maintaining new equipment, but also cost savings due to the electric fans. The annual sums budgeted for these items are currently estimates, as the exact costs cannot be known until the retrofitted buses are operating. Funds will come from the Council’s surplus revenue income. In providing financial support, the Council will be careful to adhere to the overriding principle of delivering a cost neutral outcome for the bus company involvement in this project.

3. Does the assistance distort or have the potential to distort competition?
‘No’. In terms of reputation, it is no more than a good news story. As the improvements are not public facing they will not win Centrebus more passengers alone. All bus companies operating in Leicester have been invited to come in as partners to this bid – only Centrebus have committed.

4. Does the assistance affect trade between Member States?
‘No’. LCC don’t believe that air quality is ‘tradable’. There is no equivalent of carbon trading. The DfT have stated that the CVTF Programme should contribute to the Government’s Growth Agenda; contributing to economic growth locally and nationally. We have previously worked with Arriva to deliver our CBTF 2013 commitment and we are currently working with CentreBus to deliver our CVTF 2014 commitment which has similar state aid issues. Through the CBTF 2013 and the CVTF 2014, NOx abatement equipment has been purchased from a German company. The electric fans fitted are from a British company, and the post-fitting on bus tests are most likely to be done by a British company. All these companies will gain sales and experience, which obviously may help them with future campaigns at home and abroad.

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From time to time, we receive Freedom of Information (FOI) and Environmental Information Regulations (EIR) requests about DfT grant awards.

Information provided in this application may be subject to publication or disclosure in accordance with the Freedom of Information Act 2000 (FOIA) or the Environmental Information Regulations 2004.

If you want information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a Statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence. In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information, we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances.

Please also let us know if you would be content for us to share your contact details with a third party, e.g. technology supplier.

I am content for my contact details to be forwarded to an enquirer. ☑

This page has been completed by the Senior Responsible Owner (SRO) of the proposed project[3]: ☑

Mark Wills

3 Provide SRO name and contact details in *Section A*.

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Section A. Applicant Information

Participants in Project:-

CentreBus (Appendix A)
Leicester City Council – Lead Authority (Appendix B)
Leicestershire County Council (Appendix C)

Lead Authority:
Leicester City Council

Senior Responsible Owner (SRO) name and position:-
Mark Wills
Head of Transport Strategy and Programmes

SRO telephone number: 0116 454 2811
SRO Email address: mark.wills@leicester.gov.uk

Bid Manager name and position (first point of contact) is:-
Neal Edwards
Project Manager

Contact telephone number: 0116 454 2891 or 07984 403069
Email address: neal.edwards@leicester.gov.uk

Postal address:
Leicester City Council
Transport Strategy and Programmes
Planning, Transportation and Economic Development
City Hall,
115 Charles Street,
Leicester,
LE1 1FZ

Website address for published bid (if applicable): http://www.leicester.gov.uk

A2. Please indicate if you are planning to outsource the project management either wholly or partially (if known at this stage). Note that as a capital budget, the Clean Bus Technology Fund 2015 (CBTF 2015) cannot cover the cost of project management.

Yes: ☐ Complete the form below.
No: ☑ Go to Section B.

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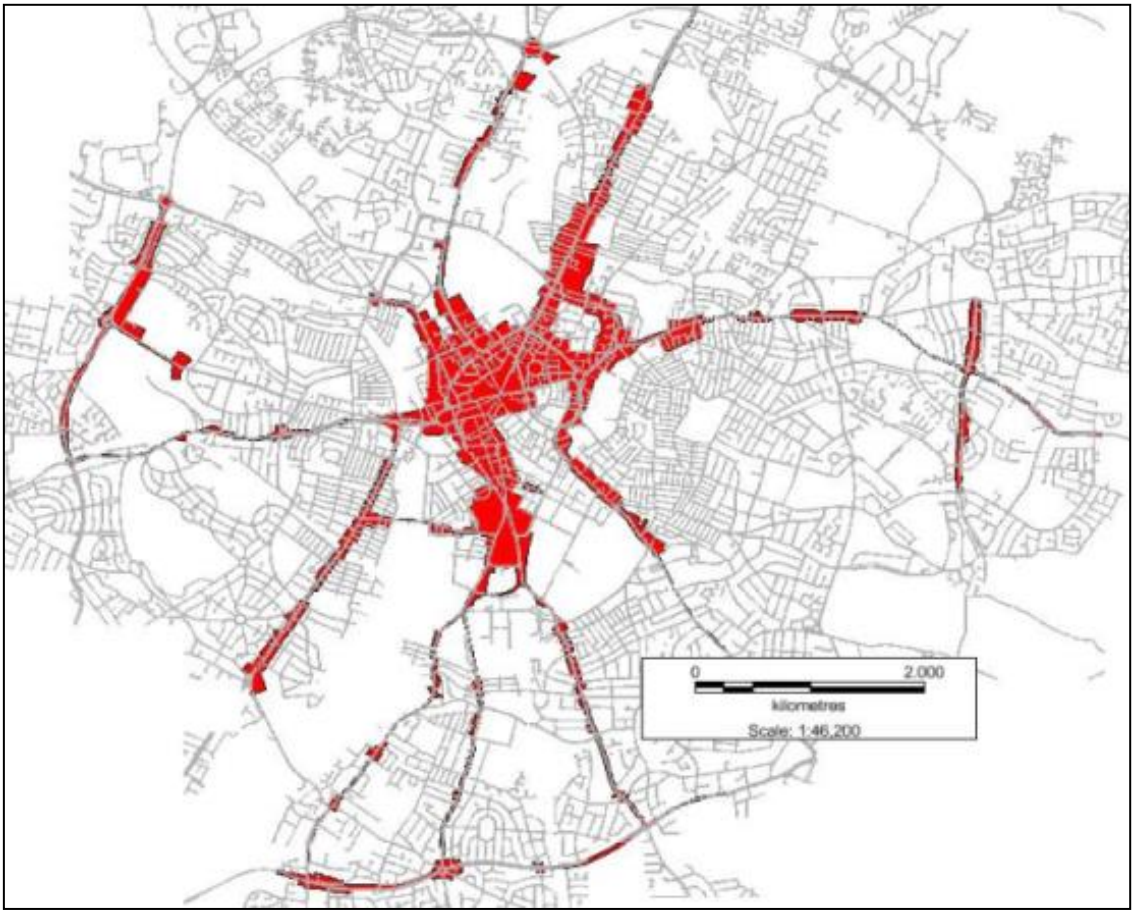
Section B. Project proposal

B1. Enter a brief description of your proposal:

Leicester City Council (LCC) has a designated Air Quality Management Area (AQMA), covering the City centre, the main arterial routes and sections of the outer ring road, due to elevated concentrations of Nitrogen Dioxide (NO2), exceeding the EU Limit Value (see map below). Road transport emissions are the predominant cause of these elevated concentrations.

Leicester Air Quality Management Areas



The 'Leicester Bus Emission Study' 2012/13 (Appendix D) determined that the Glenhills Way on the outer ring road (2014 Annual Mean for NO2 = 60ug/m3) and Vaughan Way on the inner ring road (2014 Annual Mean for NO2 = 51ug/m3) had high contributions from buses to NOx emissions; on key road sections and junctions. The study concluded that retrofitting Euro III buses with SCRT technology would have a significant impact on the corridor's air quality.

It predicted that this action could reduce NO2 concentrations significantly and will contribute to the declassification of sections of the outer ring road as an AQMA by 2020. Additionally, it would provide significant NO2 concentration reductions and reduce concentrations of fine particulates along the route. This would provide measureable health benefits.

Our most recent study LestAir (2014) (Appendices E & F) also confirmed that retrofitting Euro III buses with SCRT technology would have a significant impact on air quality.

All buses operating on the outer ring road (route 40) are Euro lll standard and the most recent automatic pollution monitoring shows NO2 concentrations of 60ug/m3 at the junction of Glenhills Way, 20ug/m3 above the EU objective.

In preparing this bid LCC approached all bus operators. Our experience with the CBTF and CVTF project has directly encouraged Centrebus to participate in this bid (Appendix A).

Centrebus have agreed to retrofit four Euro lll buses on their Route 40 which operate on the outer ring road (see route map) and one Euro lll bus on their Route 162 which operates from the city centre (see timetable) and pass through other sections of the AQMA.

These buses will be retrofitted with combined selective catalytic reduction and particulate trap (SCRT) technology and electric fans and kept in service for a five year period. This will help achieve sustained reductions in ambient levels of pollution.

Within Leicester's AQMA, these buses will add to the thirty two Arriva buses that have been retrofitted through our CBTF project and the five CentreBus buses being retrofitted through our CVTF project. LCC is committed to real world emissions tests, using PEMS equipment. For the Arriva project, these tests have recently been completed and show strong reductions in NOx emissions. The same approach will be taken for testing the emissions of the buses related to this bid.

LCC will provide revenue support to Centrebus, by covering their additional project related operating costs, and fund on-bus emission tests and ambient air quality monitoring. Leicester's Improving Bus Services group will be kept informed of progress. All relevant findings will be published.

The Arriva and First Group has expressed an interest in the bid; but have not yet committed.

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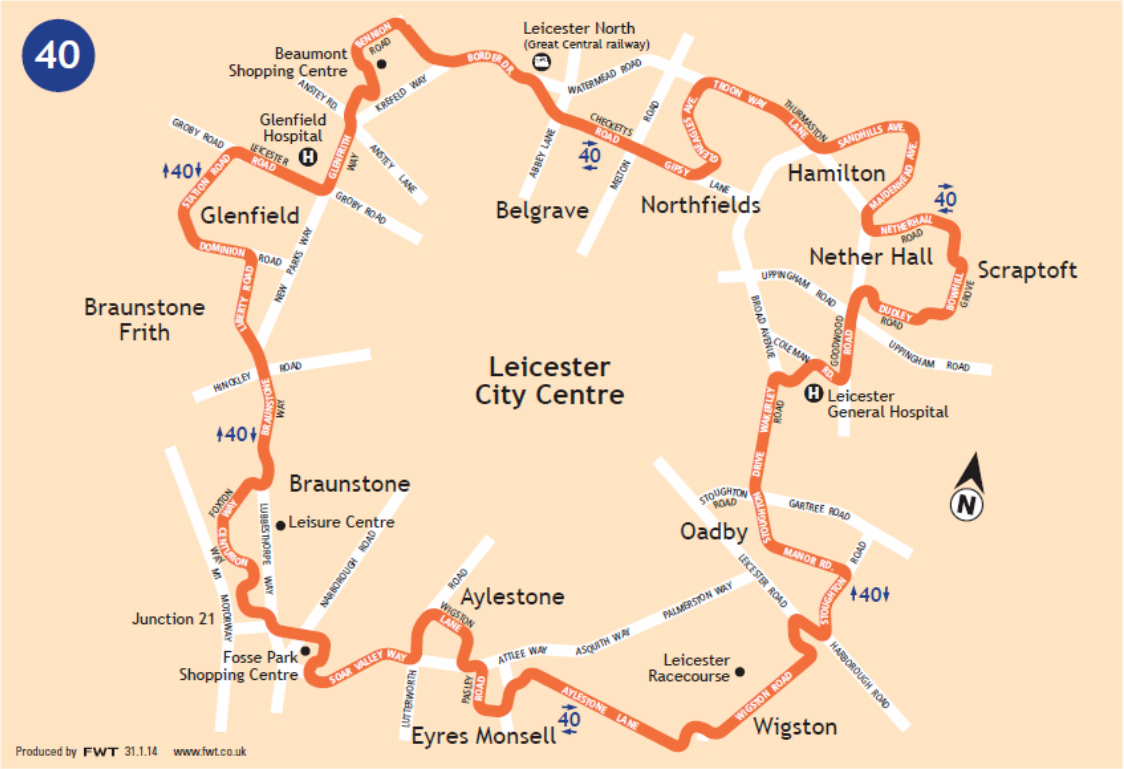
Centrebus – Route 40 (OUTER CIRCLE via General Hospital - Oadby - Fosse Park - Thorpe Astley Glenfield - Beaumont Leys - Hamilton - General Hospital)



Centrebus – Route 162 (Leicester City – via Hinckley Road - New Parks - Tatlow Road)

Centrebus

162 Leicester City Centre - Tatlow Road

Mondays to Fridays										
Leicester, Haymarket [BD]	0810	0910	1010	1110	1210	1310	1410	1510	1610	1710
Gillman Road	0819	0919	1019	1119	1219	1319	1419	1519	1619	1719
Frolesworth Road	0827	0927	1027	1127	1227	1327	1427	1527	1627	1727
New Parks, Tatlow Road	0835	0935	1035	1135	1235	1335	1435	1535	1635	1735

Mondays to Fridays									
New Parks, Tatlow Road	0840	0940	1040	1140	1240	1340	1440	1540	1640
Frolesworth Road	0848	0948	1048	1148	1248	1348	1448	1548	1648
Gillman Road	0856	0956	1056	1156	1256	1356	1456	1556	1656
Leicester, Haymarket [BD]	0905	1005	1105	1205	1305	1405	1505	1605	1705

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B2. Previous experience:

The Defra funded 'Leicester Bus Emission Study' 2012/13 (LBEST study) (Appendix D) analysed bus emissions within the city and evaluated their relative contributions to overall transport NOx emissions. It also considered the consequent pollutant effects on key corridors and the benefits of selected measures and technologies in reducing emissions and concentrations.

The Defra funded LestAir project 2013/14 (See Appendix E & F) considered the business case for the roll out of transport related low emission strategies for Leicester over the short, medium and long term. It has involved stakeholder engagement, including the local bus operators. It confirms that SCRT retrofitting of older buses used in the AQMA, is an appropriate short to medium term intervention.

This CBTF bid is informed by both the above studies and builds on our successful CBTF bid (Project BREATHE) and CVTF bid (Project BREATHE2). These bids are complementary to our successful Leicester and Leicestershire LSTF bids. Leicester's LSTF area takes in the inner and outer ring roads. The bid also complements our recently delivered BBAF project.

A successful bid to the CBTF 2015 will continue to boost the image of travelling by bus in Leicester and Leicestershire and make public transport more attractive.

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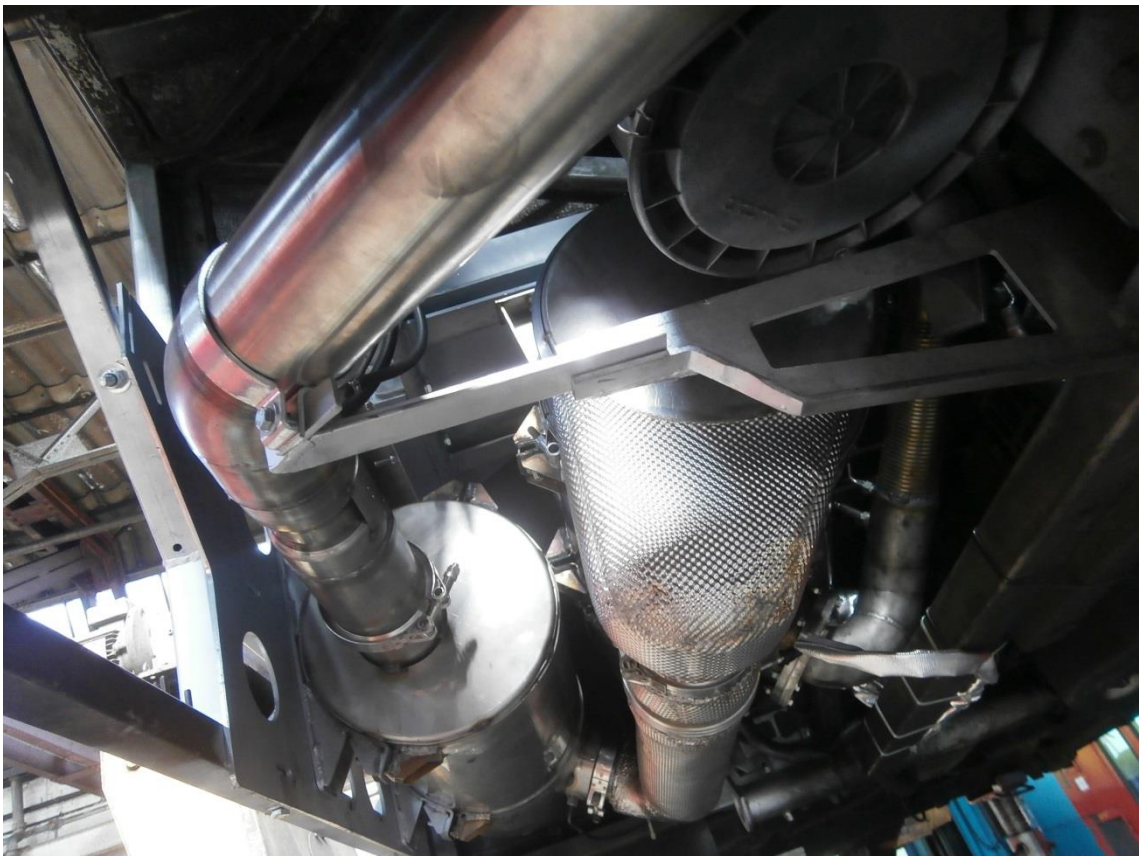
Section C. Proposed technology

C1. Describe the proposed nitrogen oxides (NOx) abatement technology for your scheme.

The Euro III buses will be retro-fitted with combined selective catalytic reduction and particle trap (SCRT), including ammonia slip catalyst.

A SCRT combines a diesel particulate filter (DPF) with selective catalytic reduction (SCR). DPF is designed to remove diesel particulate matter or soot from the exhaust gas of a diesel engine. SCR is a means of converting nitrogen oxides with the aid of a catalyst into diatomic nitrogen, N2, and water, H2O. A gaseous reductant, often aqueous ammonia or urea, is added to a stream of flue or exhaust gas and is adsorbed onto a catalyst. Carbon dioxide, CO2 is a reaction product when urea is used as the reductant.

SCRT fitted to a CentreBus Ltd Optare Solo as part of our CVTF project



The Euro III buses will also be fitted with a micro-hybrid electric fan which will replace existing hydraulic fan systems.

The eFan Micro Hybrid system reduces parasitic loads on the diesel engine and allows operating temperature to be optimised to reduce fuel consumption and improve efficiency compared with hydraulic fan systems.

A micro-hybrid electric fan similar to those fitted as part of our CBTF 2013 project

Both the SCRT and eFan system selected are proven technologies with tested benefits, thereby minimising risks of successfully deploying technology in this project

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C2. Please provide evidence of 50% or more NOx emissions reductions from the tailpipe, and the impact on other emissions including CO2 per vehicle.

Our PEMS tests from CBTF (2013) analyse real-world emissions for the modified buses on their operational routes.

Phase 1PEMS tests results show a very positive average NOx reduction of 72%. This is consistent with NOx sensor data gathered by SCRT supplier HJS, from an operational Phase 1 bus in the first six months of 2015. This also shows a 72% reduction in NOx emissions from engine out to tail pipe.

Rolling road emissions tests conducted on a retrofitted Phase 1 bus at Millbrook in October 2014. These showed the NO_2/NO ratio to always be bigger at engine out than at the tailpipe.

Regarding CO_2 and fuel economy, one bus shows no penalty for the NOx reduction, but the other shows a fall in mpg. This will be further investigated in the full report taking account of telematics data and retro-fit calibration. The report will include PM analysis. The retrofitted bus on the Millbrook tests passed the standards for CO_2 emissions.

Based on observed data from the Project Breathe Phase 1 PEMS and NOx sensor monitoring programmes and the TfL London Programme for the SCRT technology selected we expect the following reductions:

- NOx saving per bus (over 5 years) = 3.491 tonnes
- Direct NO2 saving per bus (over 5 years) = 0.11 tonnes
- PM saving per bus (over 5 years) = 0.41 tonnes
- Carbon Dioxide emission saving per bus (over 5 years) = 13.66 tonnes

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Pictures - Bus 1 Final PEMS Test (28/10/15)

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C3. Describe the change, in terms of equivalent Euro Standards, to the vehicle from the chosen technology.

Test results from Millbrook, PEMS and NOx sensors on our CBTF (2013) buses have shown that the selected SCRT technology consistently improves Euro III bus emissions to a Euro V (EEV) standard, almost reaching Euro VI standards.

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Section D. About the local vehicles

N.B. Questions in the table below with asterisks (*) are mandatory.

D1.	*** In total, how many vehicles do you expect to modify?**	5 (Five)

Please use the table below for only one type of vehicle make and model. Copy and paste the table if upgrading more than one type of vehicle.

Make and model:	Optare Solo
Number of single-deckers (if upgrading buses):	5 (Five)
Number of double-deckers (if upgrading buses):	Nil
* Euro Standard:	Euro 3
Name of engine manufacturer (of each type, if known):	Mercedes
* Estimated average annual mileage:	52,000 miles per vehicle
* Expected change in annual mileage as a result of vehicle modification:	Nil
* Will the modification extend the lifetime of the vehicle? If so, how long for?	No
* Estimated cost of purchasing and fitting technology per vehicle:	£21,000 (£16,000 for SCRT technology and £5,000 for the micro-hybrid eFan)
* Estimated additional operating costs/savings (including fuel) per vehicle over five years:	£2,468 (Ad Blue) – Anticipated that SCRT fuel increase will be offset by micro-hybrid eFan fuel saving

* Estimated additional maintenance costs/savings per vehicle over five years:	£6,000 cost per bus over 5 years
* Total cost of warranty for one year (if not included in cost of technology):	Nil (included in cost of technology)
*** DfT funding sought per vehicle (i.e. including one year warranty but excluding other contributions and operational costs):**	£21,000

D2. Infrastructure:

* If infrastructure included in bid, please specify type of infrastructure:	None
* Number of infrastructure required:	N/A
* **Estimated cost of purchasing and fitting infrastructure:**	N/A

D3. Monitoring:

* If monitoring systems included in bid, please specify type of monitoring system:	PEMS (Council funded)
* Number of monitoring equipment required:	N/A
* **Estimated cost of purchasing and fitting monitoring equipment:**	PEMS service likely to be contracted (estimated cost £20,000)

You can copy and paste the above table if more than one type monitoring equipment is included in the bid

D4. Geographical area:

Centrebus – Route 40
Route 40 (OUTER CIRCLE) operates within Leicester's declared AQMA. This route operates for most part on the outer ring road and connects the General Hospital - Oadby (town centre) - Fosse Park (major retail park) - Thorpe Astley Glenfield - Beaumont Leys (large local retail centre) - Hamilton - General Hospital.

The outer ring road is a very busy and congested corridor during peak periods. The General Hospital and the prestigious shopping area at Fosse Park, fronts

the outer ring road which has numerous traffic signal controlled junctions including Glenhills Way and pedestrian crossings resulting in significant pedestrian exposure to NO_2 pollution.

Centrebus – Route 162
Route 162 operates within Leicester's declared AQMA. This route operates from Leicester city centre via a section of the A47 Hinckley Road to New Parks. This route is a very busy and congested corridor during peak periods.

The bid complements our CBTF 2013 and our CVTF 2014 projects by spreading the benefits of SCRT NOx abatement to other areas of the AQMA including Glenhills Way and Vaughan Way. Our studies (Appendix D) identify these areas as having some of Leicester's highest bus contributions to NOx emissions. This bid will see 100% of buses on the outer ring road (Route 40) and Route 162 running with SCRT. Such a development will greatly benefit our LSTF funded work in this area, with its focus on encouraging active travel.

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D5. Level of oxides of nitrogen (NO_x) emissions and ambient nitrogen dioxide (NO_2) concentrations:

Leicester city council currently operates a network of 5 air quality monitoring stations located around the city within the Air Quality Management Area (AQMA), which record NOx and PM10 concentrations. Both bus routes proposed for bus retrofitting are within the AQMA and close to the monitoring stations at Glenhills Way and Vaughan Way.

Leicester is fully compliant with all current national air quality objectives set at 40ug/m3 except for the annual mean for nitrogen dioxide (NO2), within the Air Quality Management Area (AQMA).

The monitoring data obtained between 2011 and 2014 shows a gradual improvement in air quality with NO2 levels generally falling across the AQMA. Only one air quality station at Glenhills Way did not follow the general trend of improving air quality, with NO2 levels remaining static over this period. The Air Quality station located at Vaughan Way shows a slight decrease in NOx concentrations, but the annual mean recorded is still well above the EU recommended limit values of 40ug/m3. The Predicted NO2 annual mean concentrations at nearest relevant public exposure for Glenhills Way has been calculated as 46.8ug/m3, which exceeds the EU limit values for annual mean concentration of 40ug/m3.

AQ monitoring data for the outer ring road (Glenhills Way) and inner ring road (Vaughan Way) is provided in the table below. The data can be compared with the AURN (urban background) station at University of Leicester.

AQ Monitoring in Leicester

Site ID Site location	Within AQMA?	Valid Data capture %	NO2 Annual Mean Concentration µg/m3							
			2007	2008	2009	2010	2011	2012	2013	2014
AURN New Walk Centre	Y	89	32	28	33	42	30	30	25*	
AURN University of Leicester	Y	95								27
Glenhills Way	Y	99	66	67	75	80	60	62	57	60
Vaughan way	Y	98	56	57	57	68	73	56	49	51

(* = partial data, possible underestimate.)

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The table below shows the relative contribution to NOx emissions by vehicle type and direction for Glenhills Way and Vaughan Way.

Percentage contribution to NOx emissions by direction

Route	Percentage contribution to NOx emissions by direction							
	Cars	Taxis	LGVs	Rigid LGVs	Artic HGVs	Buses/Coaches	Motorcycles	Total
Glenhills Way								
North	52%	0%	8%	24%	5%	10%	1%	100%
South	46%	0%	7%	19%	4%	24%	0%	100%

Route	Percentage contribution to NOx emissions by direction							
	Cars	Taxis	LGVs	Rigid LGVs	Artic HGVs	Buses/Coaches	Motorcycles	Total
Vaughan Way								
North	58%	0%	7%	13%	3%	19%	0%	100%
South	60%	0%	7%	13%	3%	17%	0%	100%

D6. Describe your future plans for use of the modified buses.

Centrebus has committed to keep the modified buses in operation on the routes identified for at least five years. Any change in this commitment will need to be agreed with Leicester City Council and DfT. Project progress will be a standing agenda item for Leicester's Improving Bus services Group.

As part of the monitoring/audit of the buses included within this project, Leicester City Council will track the operation of the modified buses. Leicester City Council subsidy to cover on-costs for the modified buses is subject to the operation of the buses on routes specified as part of this project application.

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Section E. Project and financial governance

E1. Project and risk management:

Project Name:

Project BREATHE 3 **(B**us **RE**trofit: **At**tenuating **H**armful **E**missions)
Location:

- Buses operating OUTER CIRCLE via General Hospital - Oadby - Fosse Park - Thorpe Astley Glenfield - Beaumont Leys - Hamilton - General Hospital)on A607 Belgrave Road, A6030 / A6 Loughborough Road, Leicester city centre, A6 London Road and Evington Road.
- Bus operating from Leicester city centre via the A47 Hinckley Road to New Parks

The project will be managed by Leicester City Council using Prince 2 compliant methodology

We aim to complete this project by the end of June 2016. The milestones and timeline are informed by our CBTF 2013 and CVTF 2014 experience. All parties likely to be involved in this project have relevant previous experience which gives us confidence in presenting this schedule.

Timelines: See table below

Milestones:

Early December 2015 – Funding awarded

By the end of December 2015 – Funding received

January 2016 – City Mayor approves MoU with DfT

January to February 2016 – Technology procurement

January to February 2016 – City Council & Centrebus produce Grant Agreement

February 2016 – PEMS test procurement

March 2016 – orders placed for technology (& thus money committed in bid year as per CBTF 2013 and CVTF 2014 experience)

March 2016 – PEMS test ramp up

March to April 2016 – SCRT eFan retrofit ramp up

April to May 2016 – electric fan fitting

April 2016 – PEMS 1; unmodified bus & PEMS 2; eFan only

May 2016 – PEMS 3; eFan & SCRT

May to June 2016 – SCRT retrofit installation

June 2016 – PEMS tests report

The following risks have been identified and appropriate mitigation suggested:

1) Selected technologies cannot be supplied and fitted as per above milestones

Mitigation: Our CBTF 2013 and CVTF 2014 experience; and the small scale of this project should ensure that this deadline is met.

2) Technology unsuitable for bus types

Mitigation: Examples of the ‘bid bus’; (Optare Solo) have been retrofitted within the CBTF and CVTF programme, suppliers know the engine.

3) Disruption to bus services due to fitting and testing programme

Mitigation: The buses identified for fitting have replacement buses identified to ensure no loss of service

4) Buses break down / taken out of service

Mitigation: Breakdowns remedied in line with Centrebus maintenance programmes. If a bus is taken out of service, the Council will be informed, and best endeavours will be made to transfer the retrofit technology to an alternative Euro III bus

5) Public perception of project

Mitigation: Stakeholder workshops as part of the LestAir Project (Appendix E & F) included discussion of retrofitting work; which was received positively. Resident and visitor health in the areas served by the buses will benefit from the anticipated emission reductions. Heightened public awareness of poor air quality.

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6) Revenue support and financial governance

Mitigation: The City Council will provide revenue support from surplus bus lane and/or parking enforcement monies. Financial governance comes from regular project progress reports to senior management.

7) Risks with chosen technology

SCRT systems remove particulate matter and convert NOx to a more benign output. Injection strategy and catalyst performance are key to reducing ammonia slip. Electric fans used with SCRT, should lead to per vehicle fuel savings; and therefore a quantifiable CO_2 saving.

	Task name	2015				2016												2016	2017	2018	2019	2020
		S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D					
1	Electric fan & SCRT Procurement																					
2	City Mayor approves MoU with DfT, confirming receipt & use of funds in accordance with CBTF objectives																					
3	Centrebus & Council work to produce Grant Agreement for transfer of DfT funds from Council to Centrebus by end of financial year in accordance with CBTF Objectives																					
4	ORDERS PLACED FOR TECHNOLOGY																					
5	SCRT & eFan retrofit – ramp up																					
6	SCRT – installation																					
7	Electric fan fitting																					
8	Ambient Monitoring : Permanent AQ analyser on Glenhills Way and Vaughan Way																					
9	PEMS test procurement																					
10	PEMS test ramp up																					
11	PEMS 1 - unmodified bus																					
12	PEMS 2 – eFan only																					
13	PEMS 3 – eFan & SCRT																					
14	PEMS test report																					
15	Additional on bus 'after' testing (Subject to funding availability)																					
16	Campaign to inform general public																					
17	DfT Progress Report every quarter																					

E2. Progress report:

Project management will include the provision of a risk register and a quarterly report will include the issues specified by DfT.

Additionally, Leicester City Council will report on the outputs and outcomes of both PEMS and AQ monitoring and any changes in bus patronage along the corridor in relation to Leicester wide data. The data will be published on: www.leicester.gov.uk

E3. Monitoring and sharing best practice:

It is expected that the Project will yield a transferrable model for achieving quantifiable emissions reductions across Leicester and the UK, while promoting economic growth in the automotive retrofitting sector, in line with the DEFRA/DfT proposals to establish a 'sounding board' and to disseminate guidance materials. Our experience will be disseminated via:

- National/Regional workshops and seminars
- Publication of DfT/Defra guidance documents
- Publication of findings on the Council's website

Leicester has already presented on its CBTF 2013 project at a DfT workshop in London; and staff have attended other seminars and workshops, which have informed this bid.

All ratified Project Breathe data including PEMS and ambient will be shared with DfT for publication

In liaison with DfT, Leicester will collaborate with all CBTF project leads to review and disseminate progress and findings, while assisting in the development of any national abatement retrofit programmes.

E4. Contributing to Government Growth Agenda:

Leicester City Council & Leicestershire County Council will work with Centrebus and other bus operators to identify training programmes to support and learn from the project in line with the Leicester Economic Action Plan (Priorities 1 & 2). There will be a growth in local skill base associated with the fitting and maintenance of the innovative technology selected (Priorities 4 & 6)

It is anticipated that the increased uptake of SCRT technology through retro-fitment will stimulate an expansion in UK operations of the selected technology

providers with a potential increase in local business activity to support the Leicester project (Priorities 4, 6 & 13)

The micro-hybrid electric fans are supplied by UK companies. Project BREATHE 3 will promote any potential benefits associated with this technology, helping UK R&D, manufacturing and supply chain interests.

The project will directly contribute to environment around the outer ring road, including the General Hospital and Fosse Park (a major retail park), and the city centre and A47 Hinckley Road within the AQMA. The proposals will contribute environmental improvements to increase the attractiveness of these areas (Leicester Economic Action Plan, Priorities 7, 8, 9 &10)

E5. Outsourcing:

PEMS monitoring is contracted to assess the changes in emissions associated with the equipment fitted to the buses. This will allow a robust evidence base to be developed, informing the costs and benefits associated with the CVTF project and informing further activity/future strategies.

On-bus emission monitoring will be required on: a non-modified Euro III bus, a bus fitted with efan only and a SCRT/eFan bus. The monitoring output will be evaluated, reported and relevant findings published.

The total cost of outsourcing for this project is estimated at; £4,000 contractor project management of PEMS tests; £16,000 for PEMS test monitoring and an estimated £4,000 for a project technical advisor. This comes to a combined figure of £24,000.

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N.B. Questions in the table below with asterisks (*) are mandatory.

E6.	*** Total DfT funding contribution sought as specified in sections D1 to D3 (up to £500,000):**	£105,000 (£21,000 per bus x 5 buses)
E7.	*** Total estimated cost of outsourcing and operational costs (not covered by CBTF 2015) (£):**	£4,000 PEMS Project Management & £16,000 PEMS real world emissions monitoring. £4,000 for project technical advisor Plus contribution of £42,340 towards on-going operational costs (£2,468 AdBlue & £6,000 additional maintenance costs per bus x 5 buses) All LCC funded.
E8.	**If applicable, local authority contribution to capital cost (£):**	Nil
E9.	**If applicable, other contribution (e.g. bus operator or public body) (£):**	£30,000 for engine/turbo replacements and £15,000 for vehicle refurbishment , repaint & vinyl's (£9,000 per bus x 5)
E10.	***TOTAL ESTIMATED COST OF PROJECT (£):**	£216,340 including LCC & Centrebus's contribution

Section F. Supporting evidence

F1. Please use this space to provide any additional evidence for your proposal.

The project brief has been developed in line with the Leicester Bus Emission Study 2012/13 (updated with 2013 & 2014 data) – Phase 1 Outputs (See Appendix D).

Department
for Transport

Appendix A – Letter from Centrebus Ltd

Centrebus Ltd

Your local bus service provider
102 Cannock Street
Leicester
LE4 9HR
T: 0116 298 7222
F: 0116 276 0969
E: info@centrebus.com
W: www.centrebus.com

Mr A L Smith Director of Planning,
Transportation and Economic Development,
Leicester City Council.
Attenborough House
Charles Street
Leicester.

22nd October 2015

Dear Sir,

RE: Clean Bus technology fund 2015

I write to confirm that Centrebus Ltd are keen to take part and support the Clean Bus Technology Fund 2015 bid being submitted by Leicester City Council.

Centrebus Ltd operates service 40 and 162 throughout the day operating through some of Leicester's pollution hot spots. The 162 operates from New Parks via the Hinckley road into the city and the 40 is a circular route passing close to Fosse Park which again is seen as a very busy, congested and vehicle polluted area.

Our commitment is to operate suitably modified, refurbished Euro 3 engine solo's on this service and to add appropriate clean bus vinyl's as agreed with Leicester City Council and / or DFT.

Should you require any further information please do not hesitate to contact me.

Yours sincerely,

K Hayward

K Hayward
Centrebus Ltd

Department
for Transport

Appendix B – Letter from Assistant City Mayor

Please ask for: Cllr Adam Clarke
Email: adam.clarke@leicester.gov.uk
Direct Line: 0116 454 0034
Direct Fax No:

Our Ref: AC/AD

Date: 30 October 2015

Leicester City Council

Air Quality Strategy
Department for Transport
Zone 1/33
Great Minster House
33 Horseferry Road
London
SW1P 4DR

Dear Sir/Madam

Clean Bus Technology Fund 2015

Further to your call for bids to the Clean Bus Technology Fund 2015, I am very pleased to enclose Leicester's bid.

As a City we recognise the importance of improving our air quality and also the key role that bus companies play in achieving this. One of our priorities is to improve the quality of local bus services, in order to support economic development and reduce air pollution. This project helps to deliver this priority.

The Council's Clean Bus Technology Fund 2013 and Clean Vehicle Technology Fund 2014 projects are a significant boost to work aimed at reducing NOx emissions in Leicester. They both focus on parts of our designated Air Quality Management Area, where studies have shown the contribution from buses to be highest. This bid complements our CBTF and CVTF work, and will help us achieve sustained reductions in ambient NO_2 concentrations.

In developing this bid we have consulted local bus operators; and have obtained a firm expression of interest from Centrebus Ltd. If successful, I am committed to delivering all the elements covered by the bid; in partnership with Centrebus Ltd and other stakeholders.

Yours faithfully

Cllr Adam Clarke
Assistant City Mayor – Energy and Sustainability
Councillor for Aylestone

LEICESTER CITY COUNCIL
City Hall, 115 Charles Street, Leicester, LE1 1FZ
www.leicester.gov.uk

Department
for Transport

Appendix C – Letter from Leicestershire County Council

Leicestershire County Council

Mr A L Smith
Director of Planning, Transportation and Economic Development
Leicester City Council
City Hall
115 Charles Street
Leicester
LE1 1FZ

Date: 26 October 2015
My Ref: PC/tr
Your Ref:
Contact: Phil Crossland
Phone: (0116) 305 7001
Fax: (0116) 305 7014
Email: Phil.crossland@leics.gov.uk

Dear Andrew,

Support for the Clean Bus Technology Fund 2015

Leicestershire County Council is please to support Leicester City Council's bid to the Clean Bus Technology Fund 2015.

The buses identified operate on the outer ring road (Route 40) and the Hinckley Road (Route 162) corridors of the city and serve a number of key locations and settlements including the General Hospital, Oadby, Fosse Park (major retail park), Thorpe Astley, Glenfield, Beaumont Leys shopping centre, Hamilton and New Parks.

We believe that the bid package focuses on the main objective of reducing oxides of nitrogen (NOx) emissions from local buses along these busy and congested corridors which will help with overall air quality.

The bid is complementary to the County Councils BBAF project and the Council's CBTF 2013 and CVTF 2014 projects in boosting the image of travel by bus and making public transport more attractive.

We look forward to hearing about the success of the bid.

Yours sincerely,

Phil Crossland
Director

Environment and Transport Department
Leicestershire County Council, County Hall, Glenfield. Leicestershire LE3 8RJ
Telephone: 0116 305 0001 Fax: 0116 305 0006 Minicom: 0116 305 0007
Email: etd@leics.gov.uk

Phil Crossland, Director

www.leics.gov.uk

INVESTOR IN PEOPLE

Department for Transport

Appendix D – Leicester Bus Emission Study 2012/13 (updated with 2013 & 2014 data)

Air Quality assessment of the contribution of buses to the total emissions of NOx in Leicester.

Air Quality monitoring in Leicester

There were 9 air quality monitoring stations in Leicester in 2011. Four of the stations were decommissioned due to the yearly average being below the national limit for NO_2 of 40 µg/m^3

The table 1 below shows the monitored NO_2 data collected by the Pollution Team at the LCC over a period of 8 years. The national objective is 40 µg/m^3 yearly average.

Site ID	Site Type	Within AQMA?	Valid Data capture %	NO_2 Annual Mean Concentration µg/m^3							
				2007	2008	2009	2010	2011	2012	2013	2014
AURN	New Walk Centre	Y	89	32	28	33	42	30	30	-	-
AURN	University of Leicester		-	-	-	-	-	-	-	25	27
AL	Abbey lane	Y	95	**45**	**44**	**54**	**63**	**45**	**41**	**37**	**35**
GW	Glenhills Way	Y	98	**66**	**67**	**75**	**80**	**60**	**52**	**57**	**60**
IR	Imperial Avenue	Y	N/A	36	34	34	37	35	-	-	-
LR	London Road	Y	N/A	34	32	32	33	27	-	-	-
MR	Loughborough Road / Melton Road	Y	98	**53**	**53**	**56**	**58**	**46**	**47**	**43**	**43**
SM	St Matthews Way	Y	99	**56**	**51**	**56**	**62**	**55**	**48**	**47**	**45**
UR	Uppingham Road	Y	N/A	37	36	34	40	32	-	-	-
VW	Vaughan Way	Y	98	**56**	**57**	**57**	**68**	**73**	**56**	**49**	**51**

Table 1 AQ data for Leicester

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Maps of AQMA area in Leicester and network of monitoring stations (2011 data)

Within the AQMA, the local authority currently monitors NO2 at five automatic monitoring roadside sites (2014). There is also an urban background site that is part of the Automatic and Rural Network (AURN) run by Defra at the University of Leicester site (previously at the New Walk Centre). PM10 is also monitored at some of these sites.

Figure 1 AQMA and AQ monitoring network in Leicester.

Road vehicles are the main source of air pollution in Leicester. LCC has declared an Air Quality Management Area (AQMA) for NO_2 covering the city center as a whole, with 'ribbons' extending along the main radial and peripheral roads

Air Quality impact results – Leicester Best study

Leicester City Council's LeicesterBest study was carried out asses the emissions produced by buses in Leicester and to identify a long-term package to implement options to reduce emissions from buses.

To assist in the section of suitable routes, Leicester was divided into three geographical zones (centre, inner and outer). The zones were selected to encompass areas having similarities in urban morphology based on the local knowledge of the client. Zone one practically merges with zone two to the south of the city centre, denoting the morphological similarities of development radiating directly to the south of the city centre - thus differing to other geographical aspects.

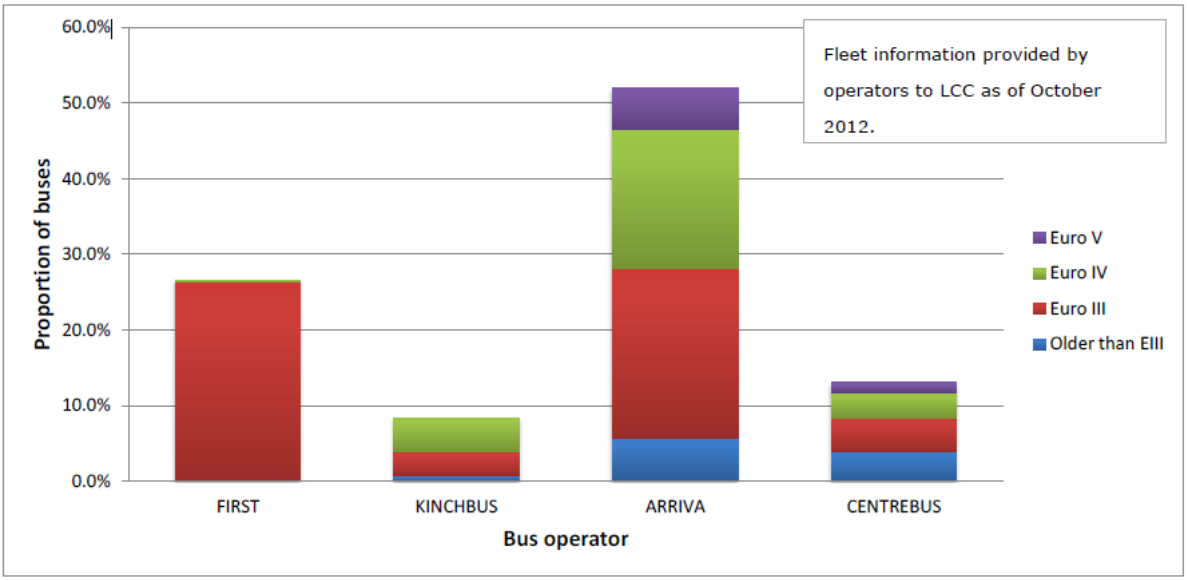
Four corridors were chosen in Leicester and air quality data was generated. The corridors were:

- Lutterworth Road
- Loughborough Road / Melton Road

- Uppingham Road
- Narborough Road.

The profile of the bus fleet used in Leicester was analysed and assembled. Graph 1 shows Bus fleet composition of 4 main bus companies operating buses in Leicester and the type of buses they operate.

Graph 1: Bus Fleet Composition.



The predominant vehicle is Euro III bus. The majority of the buses from all four operators are thirteen years old or younger (i.e. minimum of Euro III). This equates to 99 percent of the First buses, 91 percent Kinchbus buses, 89 percent Arriva buses and 70 percent of the Centrebus fleet. In terms of the total bus fleet, Arriva operate the most pre Euro III (~6 percent), Euro IV (~18 percent) and Euro V (~6 percent). Interestingly, First appear to operate predominately Euro III buses. Only Arriva and Centrebus operating Euro V. In terms of which operator may, on paper, be considered as having the greenest fleet credentials3 in Leicester, this award would belong to Kinchbus followed by Arriva, CentreBus and First. It is likely that this ranking would differ when considering in-service impacts.

The LeicesterBest project established the contribution of NOx emissions from buses at each route. Table 2 below shows the data. The biggest contribution was found to be on Loughborough road – south band 40% and the lowest was on Lutterworth road nor5th bound – 10%.

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Table 2: Percentage Contribution from Vehicles to NOx Emissions by Direction

Route	Percentage contribution to NOx emissions by direction							
	Cars	Taxis	LGVs	Rigid LGVs	Artic HGVs	Buses/Coaches	Motorcycles	Total
Route 1- Lutterworth Road								
North	52%	0%	8%	24%	5%	10%	1%	100%
South	46%	0%	7%	19%	4%	24%	0%	100%
Route 2- Loughborough Road / Melton Road								
North	46%	0%	6%	13%	1%	33%	0%	100%
South	44%	0%	5%	8%	2%	40%	0%	100%
Route 3 - Uppingham Road								
East	49%	0%	7%	13%	3%	28%	0%	100%
West	54%	0%	6%	14%	3%	23%	1%	100%
Route 4- Narborough Road								
North	58%	0%	7%	13%	3%	19%	0%	100%
South	60%	0%	7%	13%	3%	16%	0%	100%

Scenario testing

5 Scenarios were chosen in the project to be tested for their suitability to reduce air pollution by buses.

- Retrofitting buses to Euro V standard – **S1**
- Use of hydrogen buses – **S2**
- Use of CNG buses – **S3**
- Use of diesel-electric hybrid buses – **S4**
- Retrofitting buses to Euro VI standard – **S5**

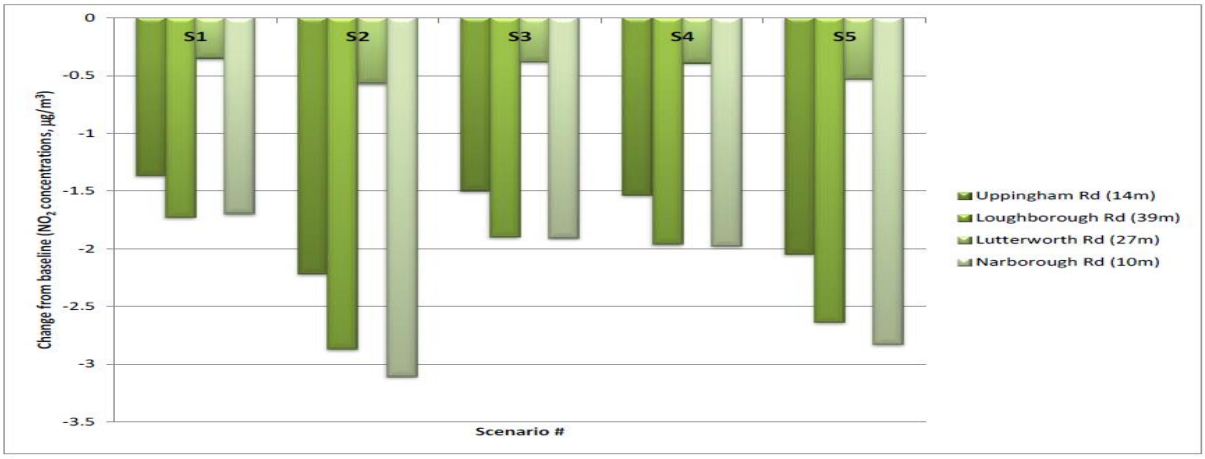
Each scenario was modelled in each corridor to asses by how much it would reduce the impact of buses on air quality.

The results of the modelling of bus emissions by using chosen technologies are presented in Table3. The technology which reduces the emissions the most is the use of hydrogen powered buses – S1, such vehicle do not produce any NOx. The second best technology appears to be retrofitting of buses up to Euro VI standard – S6 , although this kind of buses produce emissions of NOx, but they are significantly reduced.

Table 3: Impact of Scenarios on Bus Emissions at Each Corridor.

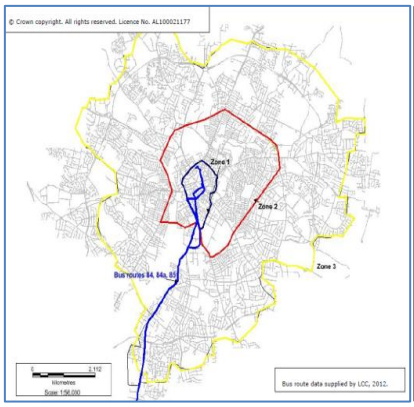
Route	Direction	NO_x emission rates (g/km/s)					
		Base	S1	S2	S3	S4	S5
1	N	0.0144	0.0061	0.0	0.0052	0.0049	0.0012
	S	0.0133	0.0048	0.0	0.0041	0.0039	0.0010
2	S	0.0258	0.0102	0.0	0.0087	0.0081	0.0020
	N	0.0189	0.0073	0.0	0.0062	0.0058	0.0015
3	W	0.0283	0.0116	0.0	0.0098	0.0092	0.0023
	E	0.0289	0.0103	0.0	0.0087	0.0082	0.0021
4	N	0.0207	0.0089	0.0	0.0076	0.0071	0.0018
	S	0.0282	0.0129	0.0	0.0109	0.0103	0.0026

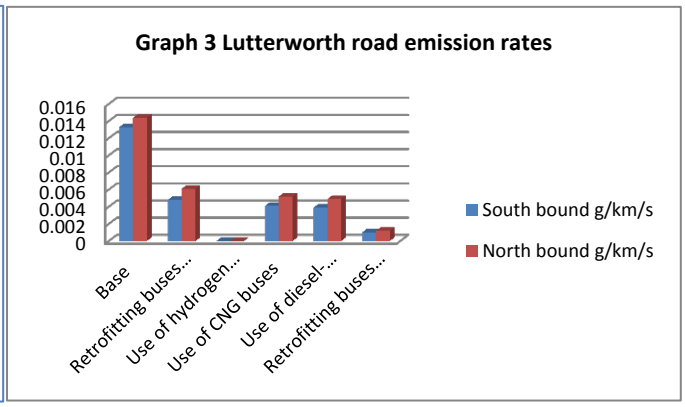
Graph 2: Dispersion Modelling NO2



The results of the modelling assessment found that concentrations at receptors were lower as a result of the introduction of the scenario compared to the baseline. Graph 2 contains the results of the modelling. The scenario that had the greatest reduction was Scenario 2 as this assumed zero emissions from buses and the second most effective scenario was Scenario 5 (Euro VI buses). The impacts on concentrations were found to be greatest at Narborough Road (>3 µg/m3 reduction for Scenario 2) and lowest at Lutterworth Road (0.5 µg/m3 reduction for Scenario 2

1) **<u>Lutterworth Road</u>**





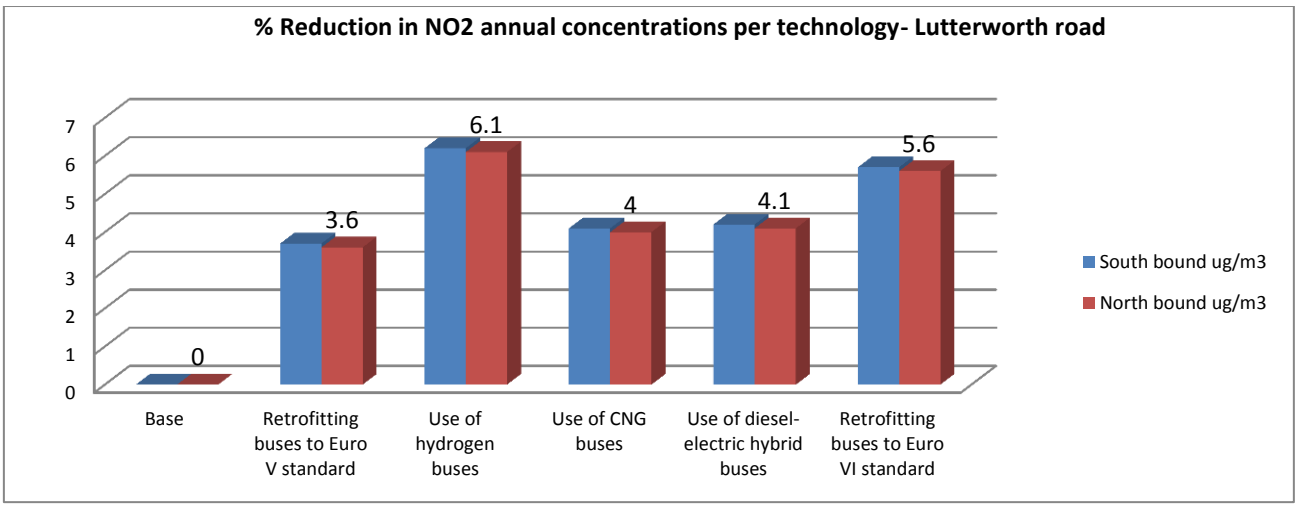
Graph 3: Lutterworth Road Emission Rates

Lutterworth Road runs from south of Glenhills Way, northwards towards the city centre. The road is serviced by bus routes 84, 84a and 85 run by Arriva.

Data in Graph 1 is presented in grams per kilometre per second of NOx emission rates. It is clear that the biggest impact on the emissions from buses has replacement

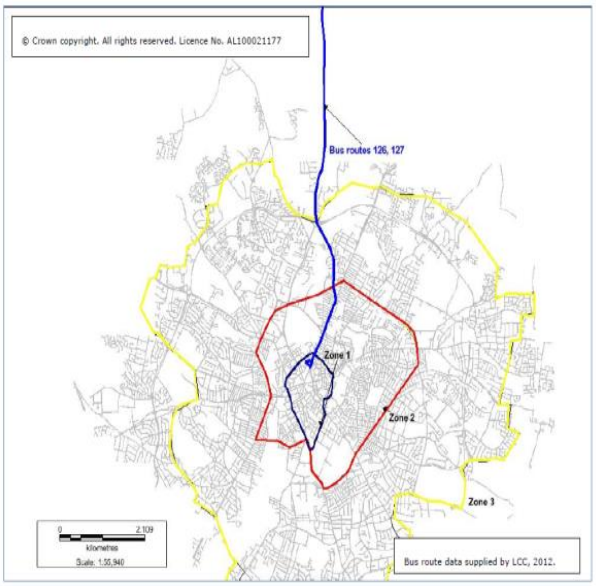
of currently used buses to Hydrogen powered buses or to retrofit the buses to Euro VI standard.

Graph 4: Percentage Reductions in NO2 Annual Mean Concentrations per Technology Applied

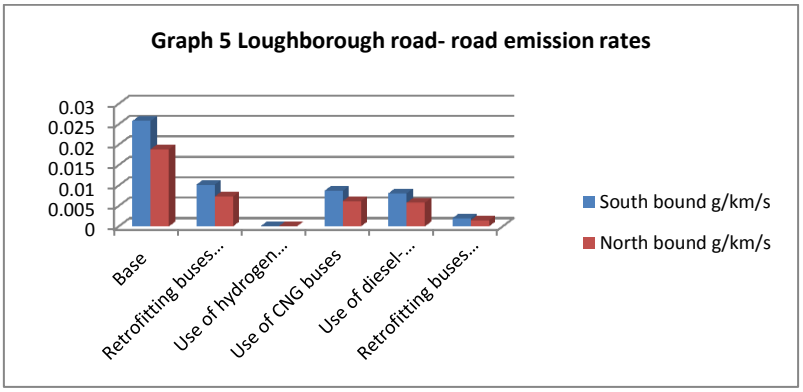


By using newer buses (Euro V) or novel technology we can achieve up to 6.1% reduction in NO_2 annual concentrations. The modelling was carried out for a receptor positioned in the centre of the road. By introducing any of the proposed improvements in the bus fleet we can achieve 3.6 % up to 6.1 % reduction in annual NOx concentrations.

2) <u>Loughborough Road / Melton Road</u>

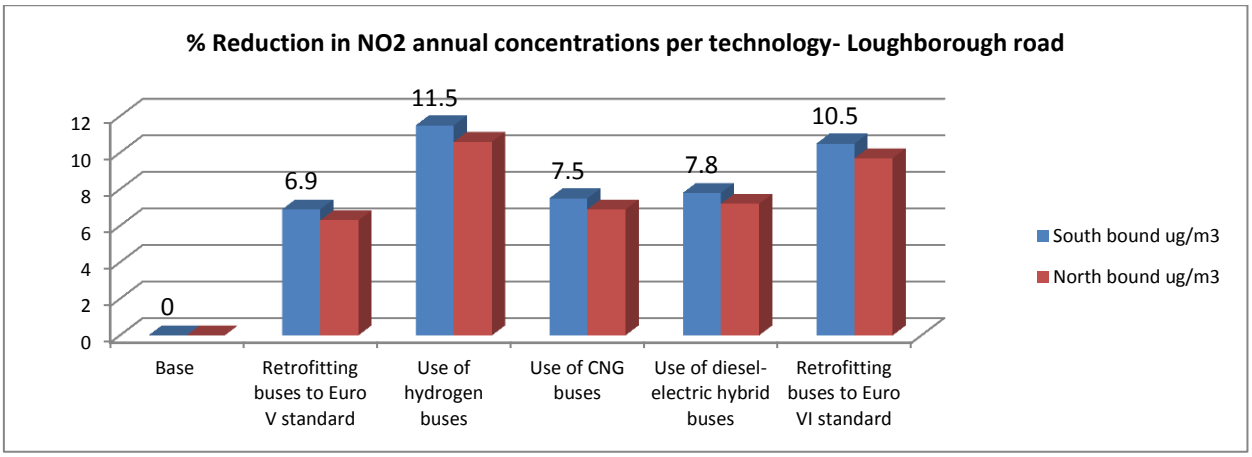


Graph 5: Emission Rates per Scenario Compared to a Base Line.



Loughborough Road / Melton Road runs northwards from the junction with Belgrave Road and Melton Road in the centre to Watermead Way (A563), the road then joins the A6 and continues out of Leicester. Arriva bus routes 126 and 127 run along the road

The data generated in graph 2 is presented in grams per kilometre per second of NOx emission rates. It is clear that the biggest impact on the emissions from buses has replacement of currently used buses to Hydrogen powered buses or to retrofit the buses to Euro VI standard.

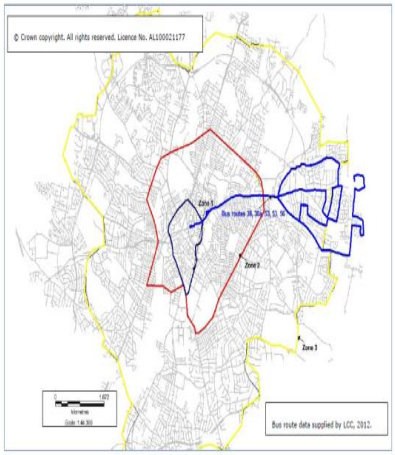


Graph 6: Percentage reductions in NO2 annual mean concentrations per technology applied

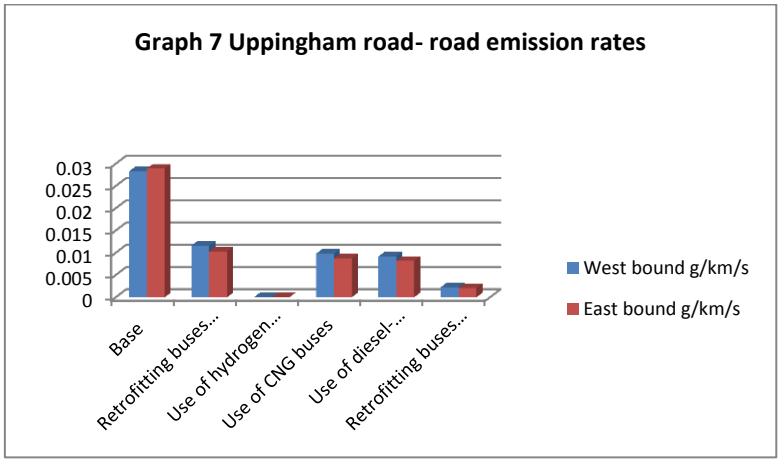
A reduction of 11.5 % in annual NO2 concentration at this route can be achieved by applying the new technology – Hydrogen buses. The second most effective technology

appears to be retrofitting bus vehicles to Euro VI standard, which would reduce the NO2 pollution by 10.5%.

3) Uppingham Road



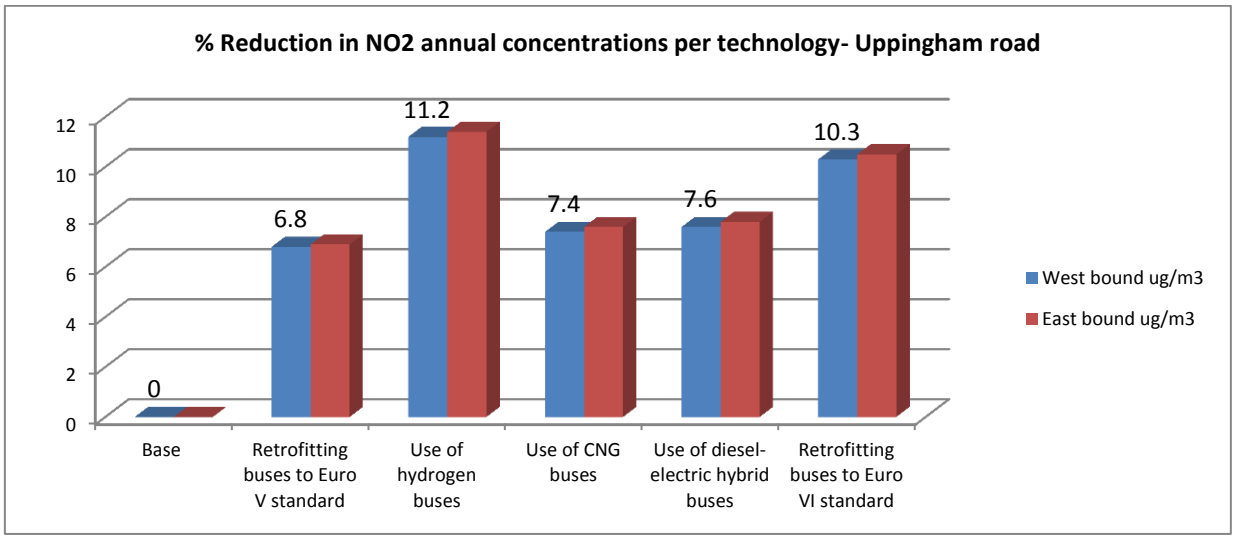
Graph 7: Emission Rates per Scenario Compared to a Base Line



The Uppingham Road (A47) runs east from the inner ring road to outer ring road (A6030). There are several bus routes operated by Arriva and First bus routes along the road

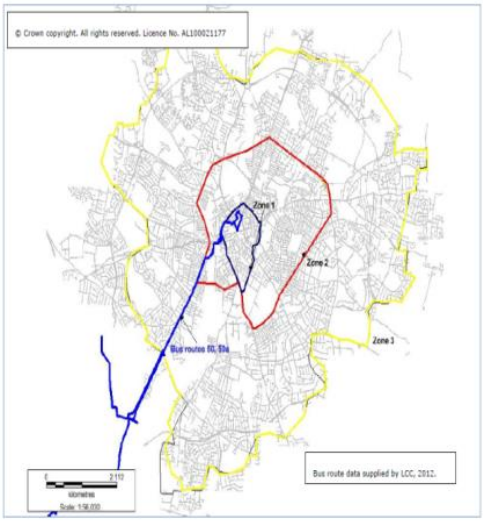
The evidence in this graph 3 suggests that the best option to reduce the emissions from buses is to replace the buses currently running on this route by Hydrogen powered buses or by retrofitted buses to Euro VI standard.

Graph 8: Percentage Reductions in NO2 Annual Mean Concentrations per Technology Applied

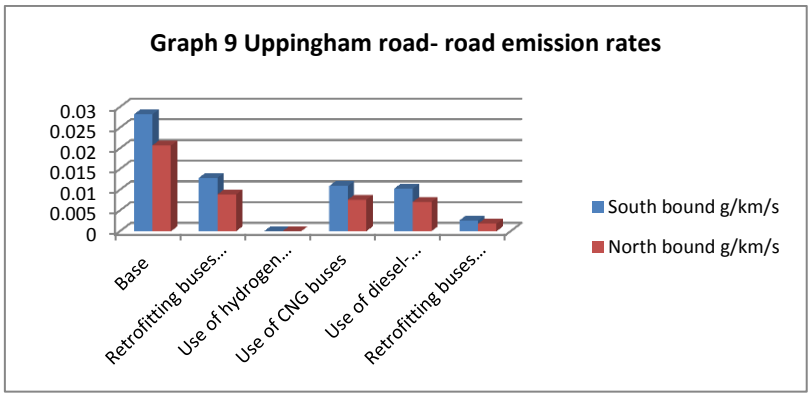


Analysis of the Uppingham road corridor revealed that the most effective technology out of the chosen ones in this project is the use of hydrogen buses. This could reduce the pollution of NO2 by 11.2 %. The second most effective solution is retrofitting of bus vehicles up to the Euro VI standard leading to 10.3 % reduction in NO2 pollution (annual mean).

4) <u>Narborough Road</u>



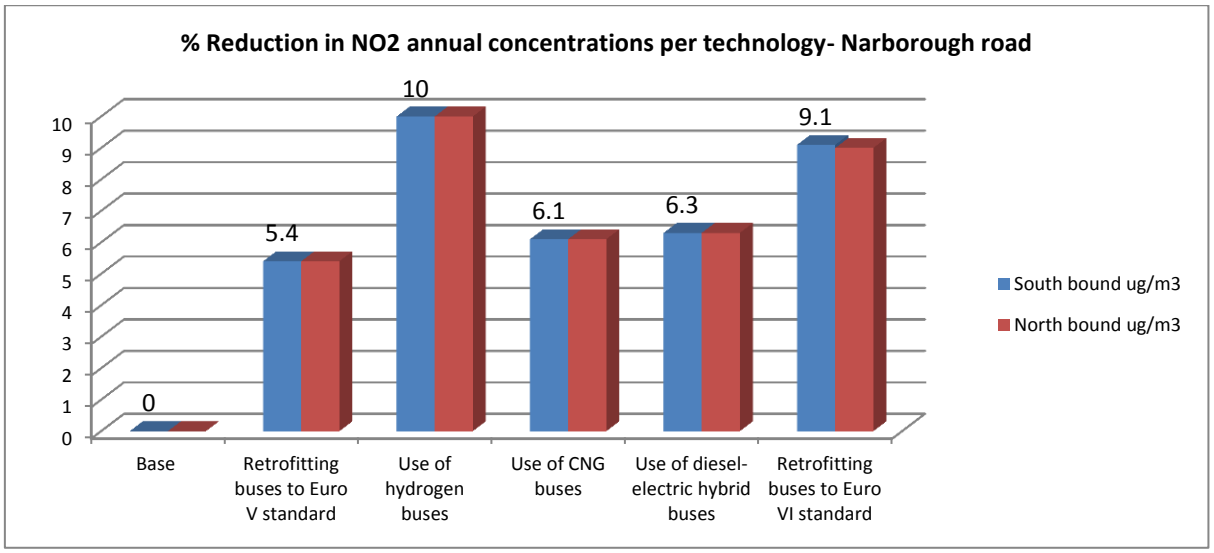
Graph 9 Emission Rates per Scenario Compared to a Base Line.



The Narborough Road runs parallel to the west of Lutterworth Road towards the city centre from Soar Valley Way, close to junction 21 of the M1 motorway. Sections of the road are dual carriageway and the Arriva bus routes 50 and 50a run along the road from outside of Leicester

As in the previous corridors researched by us the best options for the reduction of NOx bus emissions appears to be introduction of Hydrogen powered buses or retrofitting the current buses up to Euro VI standard, see graph 4.

Graph 10 Percentage Reductions in NO2 Annual Mean Concentrations per Technology Applied



The most effective technology appears to be introduction of hydrogen buses to the Narborough road corridor. With this option it appears that 10% reduction in annual NO2 concentrations can be achieved. The second technology that appears to be very effective is retrofitting of buses to Euro VI standard , which could bring 9.1% reduction.

In Table 4 we can see the annual concentrations of NO2 modelled for each corridor in this study. The receptor points were positioned in the middle of the road.

Table 4

Route	Direction	Base ug/m^3	Retrofitting buses to Euro V standard ug/m^3	Use of hydrogen buses ug/m^3	Use of CNG buses ug/m^3	Use of diesel-electric hybrid buses ug/m^3	Retrofitting buses to Euro VI standard ug/m^3
Lutterworth road	NB_centre of road	45.05	43.42	42.32	43.25	43.20	42.54
	SB_centre of road	44.95	43.29	42.18	43.12	43.07	42.40
Loughborough Road / Melton Road	NB_centre of road	40.15	37.61	35.91	37.36	37.27	36.25
	SB_centre of road	40.81	38.01	36.12	37.73	37.64	36.51
Uppingham Road	EB_centre of road	47.04	43.79	41.68	43.48	43.37	42.11
	WB_centre of road	46.54	43.39	41.33	43.09	42.98	41.75
Narborough Road	SB_centre of road	46.57	44.04	41.92	43.73	43.62	42.35
	NB_centre of road	46.20	43.70	41.60	43.39	43.29	42.03

Table 4 contains all of the data.

Based on the emission results and a preliminary investigation of the cost implications of each technology and potential ways to mobilise these measures in the bus fleet, the study that we have undertaken suggests that Euro VI standards (which will start to apply from 2014) may be the most effective means of reducing NOx and PM emissions.

Given the reduced running cost of hybrids this technology may also be an attractive option to operators.

The study and the data generated provide a reasonable level of confidence in the characterisation of bus behaviour and their contribution to emissions and air quality concentrations in Leicester.

The emissions results found that higher emission rates generally occurred in central Leicester, typically in the outward direction, e.g. for route 2 Loughborough Road and route 4 (Narborough Road. This suggests that the traffic situation in the outbound direction is more constrained on these routes. Emissions were found to typically reduce away from the city centre and these could be correlated to average speeds, idling and/or positive acceleration events.

The study also involved identifying and assessing relevant intervention measures to reduce emissions from buses and modelling their impact on local air quality. Five scenarios were tested, including specifying a minimum standard of Euro V or Euro VI and introducing alternative fuelled buses such as CNG and hydrogen. This air quality assessment found that overall NOX concentrations reduced with the introduction of the scenarios compared to the baseline and the contribution of buses to overall concentrations was substantially reduced. The ranked order of effect (least to the most effective at the top) in terms of road NOx concentrations at nearby receptors was as follows;

- Hydrogen (SC2)
- Euro VI (SC5)
- Hybrid (SC4)
- CNG (SC3)
- Euro V (SC1)

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Appendix E:
LestAir – Low Emissions Strategy: Business and Implementation Plan (Ricardo-AEA / LES Ltd 2014)

Appendix F:
LestAir Technical Paper 4: Cost benefit analysis of short listed measures (Ricardo-AEA / LES Ltd 2014)

Please note these appendices are provided as separate documents; submitted with this bid proforma.

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