

Alternative fuels: Cutting dangerous air pollution faster



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Foreword

The fact that air quality runs through much of the Environmental Industries Commission's (EIC) work should not come as a surprise given the significance of the issue.

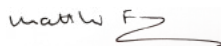
It can cause coronary heart disease, strokes, respiratory diseases, lung cancer, severely exacerbate asthma, and tens of thousands of air pollution-related deaths each year.

Founded in 1995, EIC represents the businesses which provide the technology and services that deliver environmental performance across the economy. Our members are innovative and the leading players in their field, and include technology manufacturers, consultancies, universities, and consulting engineers.

Many of them are deeply involved in the clean air sector and include firms developing and distributing 'alternative' low emission fuels. While we wait for a purely all-electric future for our vehicles, there are a series of 'easy wins' that would significantly reduce dangerous air pollution. Alternative fuels such as LPG and HVO, already widely used across Europe and the rest of the world, can provide an almost immediate impact.

No one is arguing that alternative fuels like these should be the final destination, but for densely populated urban areas they will ensure we can make progress not only by 2030, but in the next 12 months. Furthermore, the successful LPG grant scheme run by the Mayor of London for the capital's black cabs, provides a blueprint for other areas of Government to encourage alternative fuel use for other fleets of vehicles which serve the public.

This year's pandemic forced a 'new normal' on many. With people staying at home, traffic reduced drastically and air quality subsequently improved. As we slowly emerge from lockdown, economic recovery gathers pace and traffic and air pollution levels subsequently return to pre-COVID levels, we should remember that we have the solutions to improve air quality now, not just in a decade's time.



Matthew Farrow
Policy Director, EIC.



Introduction

This report identifies reasonable and practical solutions to the growing levels of Nitrogen Dioxide (NOx) and Particulate Matter (PM) pollutants in the UK, particularly in major urban areas.

The EIC member case studies shared demonstrate that by changing from a conventional fuel type, such as diesel, to cleaner alternative fuels such as biodiesel or “drop-in” alternatives like Hydrotreated Vegetable Oil (HVO), we can instantly reduce emissions in some of UK’s most polluting sectors.

There has already been gradual progress in some areas, but not all. The grant scheme for Liquefied Petroleum Gas (LPG) conversion in black taxis in London has proved successful in supporting taxi drivers to invest to deliver cleaner air for the capital before they eventually move to a zero carbon, all-electric — and more expensive — vehicle.

EIC believes the use of alternative clean fuels should be introduced as soon as possible and that Government bodies, such as Defra, Department for Transport and the GLA, should actively support the use of this cleaner technology as an interim step.

In doing so, they will deliver instantaneous reductions in emissions and reduce greenhouse gas CO₂ by 90% with no additional capital expenditure on new equipment or existing re-fueling infrastructure. There is no reason why buses, private-hire coaches, boats, planes, delivery vans and lorries and generators could not be powered by these alternative fuels.

The report sets out a series of recommendations for Government to incentivise the use of alternative clean fuels in as many of these sectors as possible.

With Government emphasis on a long-term carbon neutral future and a post-COVID green economic recovery, alternative fuels’ time has come.

Jim Mills

Chair, EIC Air Quality working group.

Founder Air Monitors Ltd.



Nitrogen Dioxide (NOx) – “High levels of nitrogen dioxide has been associated with adverse effects on hospital admissions for various diagnoses, decrements in measures of lung function and lung function growth, increases in respiratory symptoms, asthma prevalence and incidence, cancer incidence, adverse birth outcomes and mortality”. *Committee on the Medical Effects of Air Pollutants, 2015.*

Particulate Matter (PM) – Particulate pollution can harm our heart and lungs - it is linked to asthma and death. Research shows that particles with a diameter of ten microns and smaller (PM10) can be inhaled deep into the lungs as smaller particles can penetrate deeper. PM2.5 can have a particularly bad impact on health.¹

¹ Health and Exposure to Pollution, Greater London Authority – www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/health-and-exposure-pollution

Examples of alternative fuels



Liquid Petroleum Gas (LPG)

A hydrocarbon gas that exists in a liquefied form. LPG is a colourless, low carbon and highly efficient fuel. Supplied in two main forms, propane (C₃H₈) and butane (C₄H₁₀), LPG has a range of uses — from providing fuel for vehicles, leisure parks, crop-drying, BBQs and heating homes. There are many variations of LPG available, such as BioLPG.

BioLPG is renewable and sustainable, made from a blend of waste, residues and sustainably sourced materials. BioLPG, a biopropane, is chemically identical to LPG and is compatible with all LPG products meaning that it has absolutely no compromise on performance and is as energy efficient as regular LPG.²



Hydrotreated Vegetable Oil (HVO)

A cleaner burning diesel alternative fuel which can reduce exhaust gas emissions. It is a sustainable fuel derived from vegetable or used oils.

HVO is a fossil-free, low carbon drop-in diesel replacement made from 100% renewable waste, residues and vegetable oils which reduces greenhouse gas emissions by up to 90% in addition to sizeable reductions in tailpipe emissions.

BEIS have evaluated the GHG reduction potential of HVO and have published data for “generic” HVO imported into the UK confirming a “Well to Wheel” GHG emission profile of 7g CO₂e/MJ of fuel burned — or 91% GHG saving when compared against fossil diesel fuels.

HVO fuel adheres to the EN15940 standard for Paraffinic Fuels as well as ASTM D975 and has been formally approved for use by many major OEMs, although the adherence to the ubiquitous ASTM D975 standard should mean its use is valid for all equipment.

The following OEM's have formally approved and recommend the use of EN15940 Paraffinic fuels:

- **HGVs** – DAF, Scania, Volvo, MAN, Mercedes-Benz, Renault and Iveco
- **Passenger cars** – Mercedes-Benz, DS Automobiles, Citroën, Volvo, Renault, Peugeot and Nissan
- **Non-road** – John Deere, Agco, Caterpillar, Steyr, Scania, Volvo, FPT and JCB
- **Aviation** – An aviation variant is being developed by KLM.

²What is LPG?, Calor Gas (2019) – www.calor.co.uk/lpg



Progress on air pollution is too slow

High levels of air pollution are leading to death and ill-health. The current COVID-19 pandemic has made clear how those with the sort of long-term respiratory conditions, that can be caused or exacerbated by air pollution, are more medically vulnerable as a result.

In recent years, political and media focus on the public health costs of air pollution and the need to tackle it have grown dramatically, and we are starting to see some policy initiatives in response. The Net Zero agenda has also clarified the long-term solution with a widespread shift to electric vehicles and electrification in general expected by the 2030s. However, given the current public health impacts of air pollution, we cannot wait. Where technologies are available that can make a difference in the short-term, they must be used.

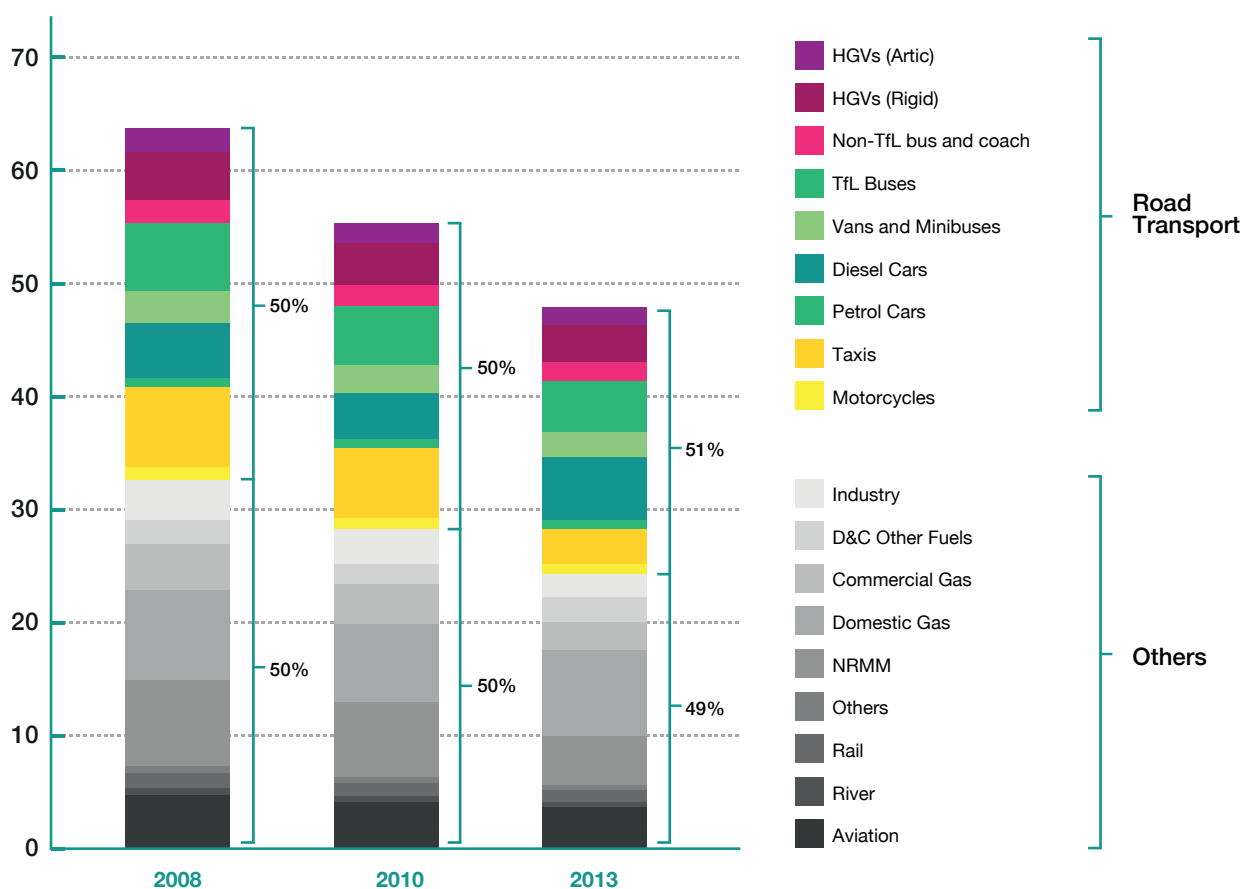


Figure one: Emission trend and main source categories in London – NOx 2008 - 2013

Source: GLA³

There have been some isolated examples of alternative fuels being positively used to tackle air pollution — for example London’s black cabs — but these are very much the exception not the rule. Outside of London, where the Ultra Low Emission Zone aims to reduce NOx pollution by 20%, progress on Clean Air Zones is slow.

Air pollution and the harmful emissions in some of the UK’s largest cities and towns could increase unless more instant action is taken.

³London Environment Strategy, Greater London Authority (2017) – www.london.gov.uk/sites/default/files/appendix_2_evidence_base

Case study: London's black cab LPG conversion scheme



A good example of where action has been taken is the GLA extension of grant funding for LPG in London's black cabs in 2018.⁴

The move to the all-electric black cab is one that, again, will take considerable resources and time. For some drivers it is an unrealistic financial proposition to switch to an all-electric vehicle in the short-term.

An additional £2.5 million grant funding was announced in 2019 for LPG conversion, provided by the Mayor and Transport for London. The increase in the overall grant to £5 million will provide a £5,000 grant to an additional 1,000 TX4 Euro 5 owners.

LPG is an effective and low-cost way to reduce particulates emissions to a minimal level improving air quality from the black cab fleet while also reducing carbon compared to diesel.

GLA involvement in providing a 'stepping-stone' to alternative fuels through the use of grants demonstrates the practical measures that can be taken by government in reducing London's air pollution.

⁴ Press Release, Transport for London (December 2018) www.tfl.gov.uk/info-for/media/press-releases/2018/december/mayor-and-tfl-launch-bold-plans-to-tackle-london-s-lethal-air Info for taxis, Transport for London (2019): www.tfl.gov.uk/info-for/taxis-and-private-hire/emissions-standards-for-taxis



Liquid Petroleum Gas (LPG)

LPG is a market available fuel that is commonly used in parts of Europe. For example, in Italy around 5% of cars and trucks run off LPG. European manufacturers of cars, such as Dacia, also provide factory-converted LPG vehicles for sale in the UK. Outside of Europe, Hong Kong has converted around 20,000 taxi fleet vehicles to run off LPG fuel.

In the UK, the success of the LPG black cab conversion (see case study, page six) proves it is a worthwhile alternative and can provide instant reductions in emissions. The current COVID-19 pandemic has also seen an increase in LPG for household use, due to lockdown restrictions being put in place. Specifically at a time when the UK Government is seeking to reduce lockdown measures and 'kick-start' the economy, LPG provides the added benefit of reduced CO₂ emissions, making it a credible alternative which can be promoted as part of a 'Green Recovery'.

Bio LPG – A Renewable Future, a report commissioned for the World LPG Association identified that in most cases where BioLPG was used, the carbon footprint was significantly lower compared to conventional diesel.⁵

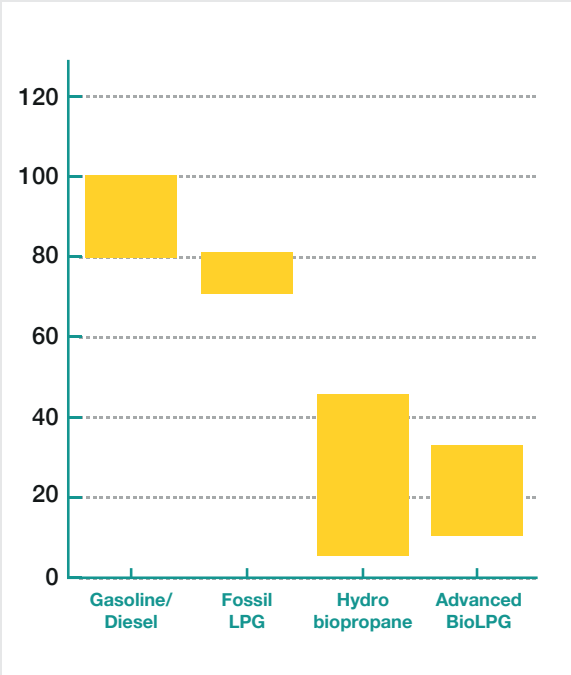


Figure two: Carbon footprints of BioLPG and competitors (base cases)

Source: *Bio LPG – A Renewable Future* (WLPGA)

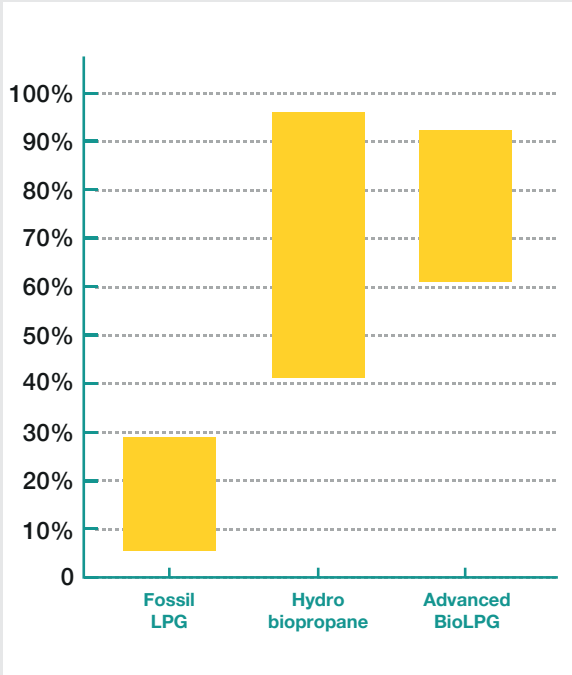


Figure three: Carbon footprint reductions of BioLPG and fossil LPG compared to gasoline/diesel (base cases)

Source: *Bio LPG – A Renewable Future* (WLPGA)

⁵ BioLPG – The Renewable Future? WLPGA (2018) – www.wlpga.org/wp-content/uploads/2018/10/BioLPG-The-Renewable-Future-2018.pdf



Low-emission fuels can make an immediate difference

Currently, there are many variations of ‘alternative fuels’ available on the market both globally and in the UK. The drive for cleaner air and the gradual shift away from fossil fuels has meant production of some ‘alternatives’ has excelled. Biodiesel, for example, has seen a rise in global production over the last seven years with noticeable gains in Europe. Neste, one of the largest global producers of Hydrotreated Vegetable Oil (HVO) already has a production capacity of around 2.5 million tonnes per year.⁶

In Europe, major companies like Total and ENI have already invested in modern HVO production units. Uptake, too, in European countries has mirrored the increase in production. In France, HVO usage rose by 42.5% between 2014 and 2015 alone⁷ with a similar picture in in Austria, Italy and Sweden. The graph to the right shows the HVO production capacity in Europe in 2016 with the projected growth for 2020, as a result of other European oil producers increasing their investment in the HVO market.

Outside of Europe, there has also been strong growth in the US, Middle East and Asia. It is estimated that global renewable diesel production will increase four-fold from a current capacity of 4.8 million tonnes per year in 2019 to 19.7 million tonnes by 2030.

The UK has an innovative alternative clean “drop-in” fuels sector, with some smaller firms already trialing these fuels in the most polluting sectors across the country.

HVO has been utilised within continental Europe, particularly within Sweden, Finland and Holland for some time where it now finds itself ‘on pump’ and available to the general public as a green fuel. There have been many studies performed looking at its application in both road and non-road applications and it is now recommended as a “first choice” fuel by OEMs such as Scania, DAF and Volvo.

The example below outlines the findings of a major study conducted in Sweden which involved the long-term trial of 36 buses operating in the Gothenburg region.

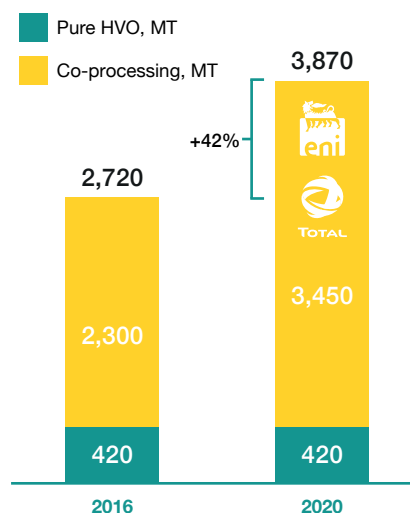


Figure four: Increasing HVO production capacity in Europe.

Source: Greenea (2017)



Figure five: Average effect of neat and almost neat (85%) Neste Renewable Diesel (HVO) on tailpipe emissions EURO II and EURO VI vehicles compared to a Sulphur-free EN 590 diesel fuel

Source: Neste

⁶ New players join the HVO game, greenea (2017) – www.greenea.com/wp-content/uploads/2017/02/HVO-new-article-2017-1.pdf

⁷ Ibid.

Case study:

Green D+

There are many domestic companies importing vessel quantities of HVO into the UK and further enhancing its performance. Green D+ is an example of this.

Specifically designed to further decrease emissions it also ensures a good engine performance through the inclusion of an additive system which chemically reduces NOx to N2. At the same time, it helps oxidise incomplete combustion products such as HC, PM, and CO. The additive package also includes a detergent which cleans the fuel system, valves and injectors.

Figure six below illustrates the difference in emissions produced by a refuse collection lorry (Euro V engine) in Hackney, London, when run on conventional diesel against the use of Green D+. NOx emissions show a nine percentage point difference between diesel and HVO. Green D+ shows a 29 percentage point reduction in NOx relative to diesel.

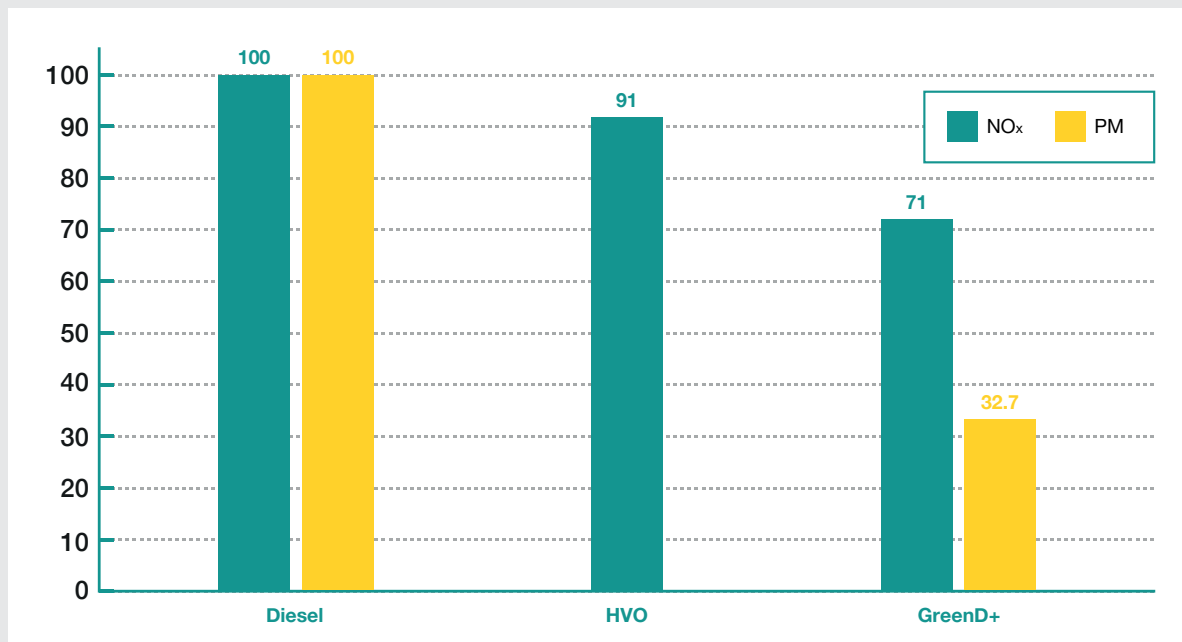


Figure six: NOx and PM Emissions reductions with Refuse Vehicle: VU66 NNH – Dennis Eagle Elite 2 –Euro V

Source: Green Biofuels



Suitable for a wide range of sectors

Off-road machinery and construction

Air pollution from construction and Non-Road Mobile Machinery (NRMM) is a concern in cities like London and EIC members believe it is an area which requires urgent attention. London has seen long-term measures put in place for road transport, including the introduction of the Ultra Low Emission Zone, the gradual electrification of the taxi fleet and hybrid or zero emission double decker buses. However, much less action has been taken with reducing emissions from generators usually running off dirty, conventional diesel.

The London Atmospheric Emissions Inventory estimated that, “in 2013 NRMM used on construction sites was responsible for 7% of NOx emissions, 14% for PM2.5 and 8% of PM10 emissions in Greater London.”

The GLA has introduced emissions standards in certain areas of Greater London and all sites in the Central Activity Zone. From September 2020, NRMM on all sites within Greater London will be required to meet Stage IIIB of EU Directive 97/68/EC as a minimum; and NRMM on all sites within either the Central Activity Zone or Canary Wharf will be required to meet Stage IV of EU Directive 97/68/EC as a minimum.⁸

While there is an urgent need for NRMM generators to meet certain emissions standards in London where retrofit technology is not available, practical solutions like clean ‘drop-in’ fuels must be used in the short-term. Making their use a prerequisite to granting a ‘limited exemption’ would mean that emission benefits could be gained in the short-term whilst progress is made toward the end goal of deploying fully compliant equipment.

EIC supports the announcement in the Chancellor’s March 2020 Budget that removes the tax rebate on red diesel (with certain exceptions) with Rishi Sunak calling it a, “£2.4 billion-pound tax break for air pollution”. The Chancellor also stated that the current tax rebate for red diesel had, “hindered the development of cleaner alternatives”.

It is imperative that the Government recognises that advanced liquid fuels are available in significant commercial volumes now and that a move to incentivise these products through, for example, shifting excise duty boundaries will ensure that they are more accessible.

With the removal of the rebate, the money generated instead could be used by government to incentivise the uptake of cleaner alternatives for NRMM on a national basis. Additionally, money could also be used for effective regulatory enforcement if such clean ‘drop-in’ fuels were to be adopted for the sector in the short-term.

Back-up generators

The Net Zero agenda has clarified the long-term solution with a widespread shift to electric vehicles and electrification in general expected by the 2030s. However, with demand for electricity set to rise, coupled with the shift away from excess grid capacity, the ability to provide additional capacity to the grid in as clean a way possible remains a concern. The emerging capacity market consisting of standby generators, operating in the STOR market, frequency correction market and triad management scheme, operate by generating electricity in peak times, usually through the burning of conventional diesel as demonstrated in figure seven from the Solutions for Energy Storage (SEnS) at the University of Strathclyde.⁹

This is a concern in high density areas, in cities such as London for example. Whilst many, but not all these installations are covered by the Medium Combustion Plant Directive (MCPD) regulations, many operators choose to limit their available run time to remain compliant rather than retrofit abatement technology. Therefore, the mandated use of advanced fuels would provide immediate GHG reductions and improved emission control whilst supporting the legislation and long-term goals already in place.

⁸ Renewable Diesel 2030: Low Carbon Fuels for Air, Land and Sea, Renewable Markets Online (2017) – www.emerging-markets.com/dropinfuels/

⁹ Non-Road Mobile Machinery (NRMM) – A guide, Greater London Authority (2018) – www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/nrmm

Ricardo Energy and Environment, in partnership with the City of London Corporation and Westminster City Council, produced a report looking at the use of standby generators in the City of London used in the STOR market and triad management scheme.

Alarmingly, it stated that while: "stand-by generators typically operate for 25 hours or less each year, they are not optimised for emissions performance. Increasing their annual running hours can therefore be of concern. For example, a 4MW current model diesel generator would create the same mass of NOx as 175 London Buses (Euro IV emissions standard) over a one-hour period."

While the data on numbers and emissions results of these back-up generators are unclear, the pressure to continue to supply electricity back to the grid will continue. Running generators operating in the capacity generating market off an alternative, clean 'drop-in' fuel such as HVO is an instant solution to help improve air quality in areas like London.

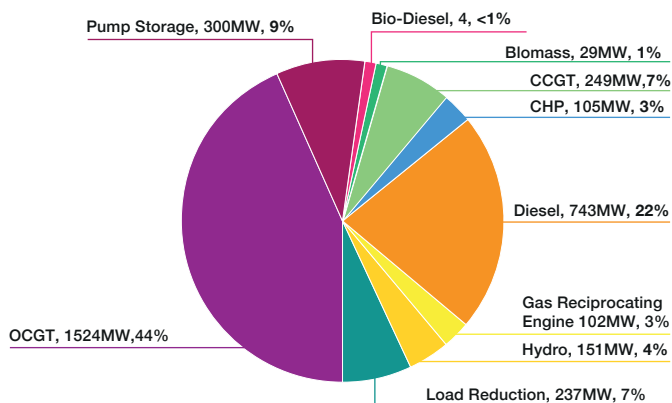


Figure seven: Short Term Operating Reserve fuel type analysis

Source: Solutions for Energy Storage, University of Strathclyde

Other uses

With lockdown measures seeing an increase in household use, likely to continue as the work from home culture continues, consideration should also be given to financial support for the adoption of HVO in the home and commercial heating sector to speed up the replacement of fossil fuel by HVO which reduces greenhouse gas emissions by up to 90%.

Kwik Trip

CNG	1.59 ⁹ / ₁₀
LNG	2.69 ⁹ / ₁₀
DIESEL	4.09 ⁹ / ₁₀
PREMIUM DIESEL	4.12 ⁹ / ₁₀
B5 BIO-DIESEL	4.17 ⁹ / ₁₀
B20 BIO-DIESEL	4.28 ⁹ / ₁₀
OFF-ROAD DIESEL	3.67 ⁹ / ₁₀
DEF	2.89 ⁹ / ₁₀
PROPANE	2.99 ⁹ / ₁₀
UNLEADED	3.91 ⁹ / ₁₀

PUBLIC WELCOME

ENTRANCE

Small policy changes to kickstart the market

We need immediate action on the adoption of alternative clean fuels for all high polluting sectors, like NRMM and standby generators.

COVID-19 has highlighted the real change needed in reducing emissions and improving public health. It also provides the opportunity for government agencies to help restore the levels of cleaner air experienced by so many during the lockdown period. With Government focus on long-term solutions like the Net Zero agenda, this simply does not address the air quality issues of today.

With the Government focus on rebuilding the UK due to the economic fallout from this pandemic, we are seeing emission rates rise once again. EIC members have worked to trial such fuels in various sectors. However, Europe is already past this stage, as is most of the world, on its adoption of cleaner technology as an interim step.

While London has seen some uptake in the use of cleaner alternatives, the case study from London demonstrates how the LPG fuel incentive can act as a interim step in advance of the eventual electrification of all black cabs in London. Despite, its success, there is still no similar scheme for NRMM offered by the GLA.

Encouraging regional and local government to take a lead role could be a way to improve local levels of air pollution in the short-term across all high-polluting sectors, seen with the HVO trial in refuse collection lorries by Hackney Council in London.

Policy recommendations:

1. Include “clean” fuel usage as a prerequisite to any granting of exemptions for NRMM equipment emissions standards. This could be policed by using commercially available sensors and telematics to ensure that these fuels are being used.
2. Money generated by the removal of the rebate for red diesel announced in the Chancellor’s Budget to be used for effective enforcement of sectors that adopt cleaner alternative fuels, such as NRMM and generators used in the STOR market and triad management scheme.
3. Money generated by the removal of the rebate for red diesel announced the recent Chancellor’s Budget to be used to help local and regional government incentivise the use of alternative clean fuels through trials in high-polluting sectors, such as refuse collection lorries and public transport.
4. Replicate trial schemes such as the TfL/GLA grant funding of LPG conversion in black cabs to include other high polluting sectors, for example NRMM and construction machinery where emission abatement technology is not currently available.
5. While the Renewable Transport Fuels Obligation (RTFO) encourages alternative fuels to be used in inland waterways, shipping in international waters is not covered by it. The possibility of imposing an internationally applicable form of RTFO for shipping in international waters should be investigated through the International Maritime Organisation.
6. Incentivise fuel duty rates to encourage pick-up of alternative fuels which offer both emission profile benefits and GHG CO₂ reductions, such as HVO.
7. Incentivise a modal shift towards modes of transport that naturally deliver the lowest GHG emissions per tonne kilometre and encourage increased use of alternative fuels by those modes of transport to deliver maximum benefit.

¹⁰ Solutions for Energy Storage, University of Strathclyde (2017) www.esru.strath.ac.uk/EandE/Web_sites/16-17/Hydrogen/short-term-operating-reserve.html

Appendix: EIC Air Quality working group members

A M Technology	GPS Marine Contractors
ABG	Gramm Barrier Systems
AECOM	Green Biofuels
Air Monitors Limited	Ground-Gas Solutions
Airport Energy	Groundsure
Airtopia	Royal HaskoningDHV
Amey	HJS Emission Technology
Anthesis	Industrial and Marine Silencers (IMS)
arbnco	Indaver
Atkins	Institute For Environmental Analytics (IEA)
Bill Baker	Jacobs UK
BISAF	Johnson Matthey
Bob Larbey Associates	Lancaster University
BP Collins	Max Fordham LLP
CAFT	Mott MacDonald
Calor Gas	Oxy-Gen Combustion
Clean Emissions	PCME
Crown Oil	Ramboll
Delta-Simons Environmental Consultants	Ricardo
Derwentside Environmental Testing Services	SLR Consulting
Element Materials Technology	Storage Tank Services
Eminox	SUEZ
Energy Solutions	Temple Group
env23	Tribune Group
Eurofins Chemtest	VuCity
Extrium	Waterman Group
FutureFuel Operations	Wehrle Environmental
Geosolutions Engineering	WSP
Geosphere Environmental	

Please note that this is the second published version of this report and that an earlier version briefly circulated with less detailed recommendations.



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Founded in 1995, the Environmental Industries Commission (EIC) represents the businesses which provide the technologies and services that delivery environmental performance across the economy. In short, we are the voice of the green economy.

Our members are innovative and the leading players in their respective fields, and include technology manufacturers, developers, consultancies, universities, and consulting engineers.