Guide to low emission and alternative power sources and technologies for Non-Road Mobile Machinery in Greater London

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Abbreviations

AQ	Air Quality
GHG	Greenhouse Gases
HVO	Hydrotreated Vegetable Oil
OEM	Original Equipment Manufacturer
NO_x	Nitrogen Oxides
NRMM	Non-Road Mobile Machinery
NRMM LEZ	Non-Road Mobile Machinery Low Emission Zone
PM_{10}	Particulate matter with a diameter less than or equal to 10 micrometres
$PM_{2.5}$	Particulate matter with a diameter less than or equal to 2.5 micrometres

Contents

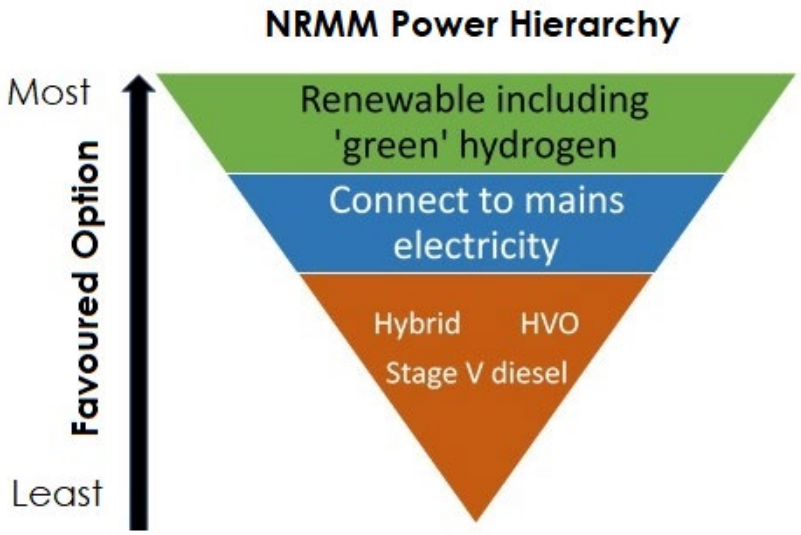
Executive Summary

Recent years have shown a growth in the market for non-road mobile machinery (NRMM) that has significantly reduced emissions of air quality (AQ) pollutants and greenhouse gases (GHG), both of which impact on the local and global environment and society. Innovative solutions and new products are regularly being released, demonstrated and put into action, whether they use cleaner fuels, run on renewable sources of power, or are more efficient in their consumption of energy. Or all three. Knowing what the possibilities are, now and in the future, to take action on AQ and GHG emissions can be confusing, depending on what NRMM is needed, what it will be used for and where.

This guide provides advice to anyone looking to hire NRMM, for a variety of reasons, on how their emissions can be reduced, whether be it for small-scale street works, welfare accommodation, street markets, filming or small construction sites. Note construction sites in London must sign up to the NRMM Low Emission Zone Register and comply by NRMM LEZ zone requirements.

Information is provided by NRMM type alongside information on the different kinds of power sources currently available, supplemented with case studies of existing machinery available. It also includes advice regarding hand tools and small plant that may not be covered within the definition of NRMM. It is intended that this guide is updated as advances and changes to the market occur.

The NRMM Power Hierarchy below outlines a quick reference route to reduce emissions, useful when considering power sources. The most favoured options are to use renewable energy, such as solar, or to be connected directly to mains electricity, and the least favoured option to use diesel engines.



Clearly the choice made will depend heavily on the actual works being undertaken, and hence the plant required, but also the physical location and time of year. It will not always be possible to reach the top of the hierarchy but using information in this guide can help move up as far as possible.

In this context renewable energy will be mainly solar, while some biofuels may be considered renewable, they will still produce pollutant emissions locally and therefore appear lower down the hierarchy. Green hydrogen produced by electrolysis which is powered by renewable electricity is also included here.

Mains electricity, particularly 'green' generated by solar, wind, hydro, is also beneficial. For example, if you have a grid connection you are at a lower risk of an interrupted supply of fuel, *and if the electricity supply is from renewable energy it can* significantly reduce GHG as well as local air pollutant emissions. Moreover, more efficient equipment means less energy consumed and more modern equipment tends to mean decreased noise outputs, enabling better working relationships with the immediate community, delivering better social value outcomes.

Where possible look at accessing renewable power such as solar panels for smaller energy requirements, such as hand tools and lighting. If that is not possible aim to charge batteries via a direct mains connection. And where neither of those are practical, such as in narrow streets or during winter or site energy demand, look at using diesel generators fuelled with hydrotreated vegetable oil (HVO), particularly those that are hybrids with supporting battery pack. Do be mindful of a more favoured option potentially having greater emissions than a less favoured option and speak to your provider to confirm your understanding and ensure appropriate equipment is obtained. For example, a stage IIIA hybrid engine is likely to have greater emissions than a stage V diesel: sites looking into hybrid options must still be cautious of the emission stage.

Summary of Recommended Power Sources by Technology Type

Technology	Recommended Power Source	Minimum Power Source (To be used if recommended power source cannot)
Hand Tools	Cordless battery power via solar power	Cordless battery power through connection to mains electricity
Lighting	Solar power where appropriate	Stage V hybrid engine
Small Plant	Stage V run on HVO	Stage V engine
Access	Indoor: electricity; Outdoor: HVO; Road-going: Euro VI compliant with battery powered lift	Indoor: electricity; Outdoor: Stage V; Road-going: Euro VI compliant without battery powered lift
Power & Welfare Accommodation	Grid connection where possible, supported by renewables as far as possible	Stage V run on HVO with a hybrid battery from renewables

Section 1: Introduction

1.1 Purpose

This document provides guidance for non-road mobile machinery (NRMM) users on mainstream and readily available technologies and power sources that can give reduced emissions of GHGs and local AQ pollutants.

It is intended as a guide for local authorities, procurement professionals, contractors and business owners who are looking to hire plant and equipment for uses such as street and road works, filming and street events. This guide will equip you with knowledge to help you make more informed decisions when buying or hiring this type of equipment, supporting your ambitions for cleaner air. The guide provides direction on actions you can take on the use of low emission options and alternative technologies and fuels, the suitability of these options for varying applications, and the limitations and benefits of these options.

1.2 Background and Context

In 2019, the UK Government became the first major economy in the world to pass laws to end its contribution to global warming. It requires the UK to bring all **greenhouse gas emissions to net zero by 2050**[1] now with an intermittent target to have reduced emissions by 78% by 2035, compared to the 1990 baseline. The UK needs to reduce emissions by 180 million tonnes of carbon dioxide equivalent between 2023 and 2032, the equivalent to taking all of today's cars off the road for around two years.[2] Furthermore, the Mayor of London has set a target for **London to be a zero carbon city by 2030**.[3]

In parallel, the Government published its **Clean Air Strategy** in 2019, setting out priorities and actions for tackling all sources of air pollution, making air healthier to breathe and protecting nature.[4] To achieve this, the UK Government has set targets for a variety of activities, including driving the growth of low carbon hydrogen, accelerating the shift to zero emissions vehicles and enabling green public transport.

[1] 'UK becomes first major economy to pass net zero emissions law' News story, June 2019, https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law

[2] The Ten Point Plan for a Green Industrial Revolution, HM Government, November 2020, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf

[3] GLA Zero Carbon London

[4] Clean Air Strategy 2019, UK Government, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

It is well established that the use of fossil fuels to power off-road plant and equipment, NRMM, contributes to two direct impacts. Firstly, **poor local AQ** and related health impacts on those working in and living around construction sites due to the emissions of particulates and nitrogen oxides. Secondly, the **global impacts on the climate** from the tailpipe emissions of GHGs, carbon dioxide in the main, and the knock-on effects this has on our weather systems in a rapidly warming planet.

The UK's construction and manufacturing sectors contribute to 16% of the total emissions of particulates and nitrogen oxides. Construction in Greater London contributes to a third of all PM_{10} emissions, 15% of $PM_{2.5}$ and 7% of nitrogen oxide emissions.[5]

Switching to cleaner and lower emission technologies that use alternative power sources has many advantages. They enable the user to be more efficient with the consumption of resources, reduce operational costs, improve community relationships through reductions in noise and fumes, and meet the requirements to work in low emission zones.

London's NRMM Low Emission Zone requires all engines with a power rating between 37 kW and 560 kW to meet an emission standard based on the engine emission "stage". Stages describe the standards that need to be met depending on where the site is. The current standards are stage IV for NRMM operating in the Central Activities Zone and Opportunity Areas (including Canary Wharf) and stage IIIB in the rest of London. *Stages IIIB and IV have not been defined for machines with constant speed engines, such as generators. This means that these machines will need to meet stage V* but due to production delays and low availability, exemptions are commonplace. Exemptions will become less lenient as stage V generators begin to appear in the market, but a fixed date is yet to be set. Stage IV has not been directly defined for variable speed engines smaller than 56 kW. In most cases these engines will need to meet stage V if they are in the Central Activities Zone and Opportunity Areas.[6] The table below shows the trajectory and context for London for AQ and GHG emissions in the coming years, ultimately to be zero emission NRMM by 2040.

[5] London Atmospheric Emissions (LAEI) 2016, Mayor of London, https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2016

[6] London's 'Low Emission Zone' for Non-Road Mobile Machinery, Mayor of London,

Greater London	2021	2025	2030	2040
Engines with a power rating between 37 kW and 560 kW	Stage IV for construction machinery operating in the Central Activities Zone and Opportunity Areas (including Canary Wharf) and stage IIIB in the rest of London	Stage IV	Stage V	Only Zero emission machinery

Finally, from April 2022, the UK Government will be removing the entitlement to use red diesel from the construction sector, ensuring that businesses pay for the emissions they produce and to incentivise the development and adoption of greener alternatives.[7]

[7] Consultation on reforms to the tax treatment of red diesel and other rebated fuels, Consultation outcome, 3rd March 2021, https://www.gov.uk/government/consultations/consultation-on-reforms-to-the-tax-treatment-of-red-diesel-and-other-rebated-fuels

Section 2: Low Emission and Alternative Fuels and Technologies

2.1 Hand Tools

	Power Source	Benefits
Handheld tools such as saws, breakers, compaction equipment, pumps and drills can be powered by batteries or from the mains via a flex cable. Where possible look for cordless battery-powered to avoid the restriction of a finite flex and the associated trip hazards that go with that. Battery power has many advantages to fossil fuel use. It significantly reduces carbon emissions when charged from a sustainable source, such as a direct connection to the grid or even better from a renewable source such as solar panels. Possibly more importantly, when compared to a petrol- or diesel-powered alternative, they reduce AQ emissions for the user and local neighbourhood. Furthermore, without a combustion motor, they also reduce noise, helping to maintain productive relationships with local communities.	Cordless battery power through connection to mains electricity	Reduced carbon emissions Improved AQ Reduced noise
Charging facilities that are mains or generator connected exist and provide a space to charge multiple battery-powered items. This is typically a centralised charging facility for cordless tools such as battery packs; cordless power tools; electric vehicles and machinery; mobile phones; and other electrical devices. They may include electric charge points, plug sockets for mains or generator connections, and can also contain powered lockers to keep tools safe.	Electric charging facilities	Centralised charging facilities can improve productivity

Case Study: Recharging battery-powered machinery from renewable energy sources

Plant hire company Think Hire has collaborated with EV3 Power to provide construction sites with solar-powered energy sources that can be used to charge electric equipment, with back-up generators fuelled by HVO. Using battery-powered machinery from renewable sources leads to a significant reduction in carbon emissions, and the use of this on a six-month Network Rail project repairing three railway bridges in Cambridgeshire reduced emissions by 88% across three site compounds.

https://www.theconstructionindex.co.uk/news/view/think-hire-forms-green-power-partnership

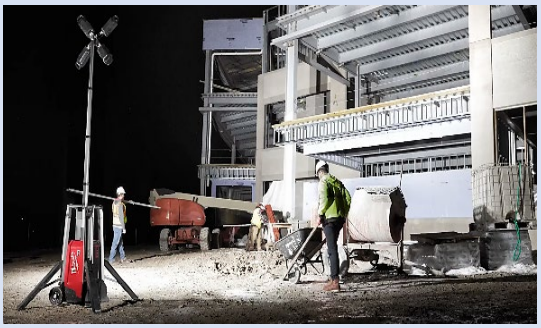
2.2 Lighting

	Power Source options	Benefits
Lighting towers find many uses, whether it's for street works, night markets or filming. There are a variety of combinations of power sources readily available on the market, including: battery and solar; solar and hybrid combination; and stage V hybrid engines. Following the NRMM Power Hierarchy, you should aim to use solar as your power source where possible. But this will depend on location and time of year – a narrow street in winter probably won't afford the sunlight needed to recharge the batteries and you will need a back-up source of power. This could come in the form of a connection to the mains, but if that is not possible, then a stage V hybrid engine can power up when needed and charge up the battery simultaneously. A street market in a large open area in summer on the other hand is good for solar – charged up in the day to be used at night. The clear benefit of solar power is that it is 100% renewable and free, leading to significantly reduced	Solar power Electricity Stage V hybrid	100% renewable Improved GHG and AQ emissions Reduced cost

carbon and pollutant emissions, as well as costs, when compared with fossil fuels. It is important that choosing a power source is viewed in conjunction with correct operator practices, to maximise the reduction in carbon emissions. For example, lighting towers should use LED lumieres that can be dimmed.

Case Study: Solar Lighting Towers

Speedy Plant Hire used solar lighting towers and calculated that in comparison with a traditional generator, it would have annual savings of 4,059 kg of CO2e per year, as well as cost savings of up to £1595.



https://www.theconstructionindex.co.uk/news/view/speedy-stocks-battery-powered-lighting-towers

2.3 Small Plant

	Power Source options	Benefits
Small plant, for example excavators and dumper trucks up to 5 tonnes in weight, should be at least stage IIIB, but where available, stage V should be the aim. Furthermore, use HVO instead of conventional diesel because of the AQ and GHG benefits - more information can be found below in the case studies. Electrically powered smaller plant is becoming increasingly available and there are many options being tested – see case study of telehandler electrification – but while this will steadily increase, they are not widely available in large numbers at present. But do ask your supplier – if the buyer does not ask, the supplier won't provide!	HVO Stage V	Reduced GHG and AQ emissions

Case Study: JCB full Stage V compliance

From Spring 2021, all JCB's new products have fully adopted EU Stage V emissions-compliant diesel engines, from a new 40kVA diesel generator to brand new compact excavators in the 3.5/3.6 – tonne bracket. This includes NRMM such as new backhoe loaders, new telehandlers, new crawler excavators, all of which are fully stage V compliant.

https://www.theconstructionindex.co.uk/news/view/jcb-goes-for-full-stage-v-compliance-with-spring-product-launch

https://www.johnsiskandson.com/uploads/pdf/John-Sisk-Son-2030-Sustainability-Roadmap.pdf

	Diesel	Electricity
Energy	2,119 kWh	240 kWh
CO_2 Emissions	560 $kgCO_2e$	0 $kgCO_2e$ (at point of use)
NO_x Emissions	11 $kgNO_x$	0 $kgNO_x$

Case Study: Electric crawler excavators

Used for mine and quarry extraction work, the new Liebherr R 976-E and R 980 SME-E electric crawler excavators are supplied with 6000 V power via a plug-in cable connection, with the cable inlet in the centre of the undercarriage. It is powered by a 6000V/50 Hz current collector and there is a switch cabinet transformer and a low voltage cabinet for power distribution. These plug-in excavators are cleaner, quieter, and cheaper to run and maintain than a conventional diesel machine.

https://www.theconstructionindex.co.uk/news/view/liebherr-revamps-plug-in-digger

Case Study: First battery-powered lorry
Drywall and partitioning supplier CCF worked with Electra Commercial Vehicles to develop the first fully electric 27-tonne curtain side battery electric vehicle. It has a charge time of seven hours and has a maximum 120-mile range on a full charge. It also includes a sensor system to alert the driver to nearby cyclists or pedestrians, five-way camera monitoring system and telematics and vehicle tracking monitor its energy use in real time. https://www.theconstructionindex.co.uk/news/view/builders-merchant-gets-battery-powered-lorry

2.4 Access

	Power Source options	Benefits
Access equipment, such as mobile platforms to reach heights, should have at least a stage V engine if being used outdoors to reduce NO_x and PM, and ideally using HVO. If they are being used indoors, they should be electric to improve indoor AQ. Platforms and booms can be fully electric, however caution must be taken when going over 60 feet / 20m long to ensure there is enough power. They can be combined in a hybrid approach with HVO, when going above 60 feet /20m. It is important that care is given to being resource efficient by reducing idling time.	Indoor: electricity Outdoor: HVO or stage V	Reduced GHG and AQ emissions
Road-going access such as cherry pickers should have a Euro VI compliant engine combined with a battery powered lift. In due course there will be vehicles on the market that have hybrid engines.	Road-going Euro VI compliant and battery	Reduced GHG and AQ emissions

Case Study: Electric lifters
All-electric versions of small plant and heavy-lift machines are becoming more popular, leading to more being manufactured. Belgian lifting specialist Sarens have released their latest model of ring-mounted crane, which is not only powered by electricity, but also regenerates its own electrical power by recovering and reusing the electricity it uses for lifting. It is designed for connection to the electric grid and there are no diesel or hydraulic components, making it quieter, cleaner and with lower maintenance requirements. When connected to the grid, it reduces electricity consumption by 40%. https://www.theconstructionindex.co.uk/news/view/electric-lifters

2.5 Generators

	Power Source options	Benefits
Firstly, if you can get a connection to the grid and avoid the need for a generator altogether, either for welfare accommodation or for powering street markets and film sets, then do so. Generators come in many sizes for powering many applications. The ability to provide capacity additional to the grid in as clean a way possible remains a concern, especially in high density areas such as London, as standby generators that generate electricity in peak times are usually powered by burning diesel. Stage V with a hybrid battery or HVO No emissions at point of use	Power Source options	Benefits Reduced GHG and AQ emissions
Depending on the size and power demand, you should look at combining a diesel engine, run on HVO to reduce AQ emissions, with a hybrid battery pack. This enables you to run the diesel engine and charge up the batteries for night-time use and for recharging smaller equipment. Stage IIIA engines are commonly available, and Stage V are becoming gradually more available in some sizes. Generator retrofitting can be expensive, and stage V is currently not readily available. Information	Generator retrofitting	Maintaining NRMM for longer

from the sector is that that, at the moment, there is a small number of small and large stage V generators available, but there are few middle-sized generators. Therefore, as the market capacity is low, until stage V is readily available in line with the low emission zone requirements, the user can provide a statement indicating that they have researched stage V generators and will purchase it when the market availability is appropriate. The Energy Saving Trust provides a certification for emissions reduction systems that can be retrofitted to NRMM to allow them to be used in areas which have emissions restrictions. Additionally, the Clean Vehicle Retrofit Accreditation Scheme (CVRAS) Register provides information of suppliers who can retrofit vehicles appropriately.	
Stages IIIB and IV have not been defined for machines with constant speed engines, such as generators. This means that these machines will need to meet stage V. Stage IV has also not been directly defined for variable speed engines smaller than 56 kW. In most cases these engines will need to meet stage V if they are in the Central Activities Zone and Opportunity Areas (OAs). There is to be no flexibility scheme for stage V. There will be a sell off provision, allowing 18 months to manufacture gensets built with prior stage engines (stage IIIA) and then a further six months to place the gensets on the market. Stage V will not be limited to low-mid power range as stage IIIA was, but instead will affect any mobile diesel generator regardless of the power output. As stage V generators become more readily available, the cost will reduce, making it a key and achievable goal for 2030. There will also be no more stage IIIA in London (other than generators), as stage IIIB is currently mandated.	

You can also consider the addition of renewable technologies, such as solar panels on welfare accommodation to reduce the need to use diesel in the generator but do consider the location of the accommodation and the time of year, as per the comments under lighting above.	Solar for welfare units Electricity	100% renewable energy Reduced AQ and GHG impact

Case Study: Approved retrofit Stage V emissions kit

Emissions control specialist Eminox has a range of retrofit exhaust aftertreatment systems for power generators and NRMM, allowing them to meet stage V requirements. They have received approval from the official NRMM Retrofit Accreditation Scheme (RAS) for a solution for constant speed engines and have launched retrofit exhaust aftertreatment systems covering 37-560 kW engine power output, accredited by the Energy Saving Trust.

https://www.theconstructionindex.co.uk/news/view/eminox-offers-stage-v-retrofit-kit

2.6 Other Power Sources

Non-fossil fuel power sources	Benefits
Electricity and battery powered We have all seen the increase in electric cars, EVs, and NRMM is no exception; there are increasingly more products on the market that run off electrical power. Generally, this is through on-board batteries that are charged up from the mains, which is especially prevalent in the smaller and handheld end of the range, but there is an increasing availability in larger equipment too. Moreover, there are developments coming to market for hydrogen fuel cells, more of which below. Electrically powered NRMM have the benefit of zero emissions at source, both GHG and AQ and reduced noise. However, to maximise their sustainability potential, they should be charged in as low carbon a way as possible. In practical terms this means from the grid, but could include renewable sources, especially at the smaller end that requires less power to be charged. At all costs though, avoid charging up electrical equipment from a diesel generator as you negate the	Zero AQ and GHG at 'tailpipe' (there is no tailpipe) Quieter running

benefits. A disadvantage of electric machinery is that they can have shorter operational times compared to conventional equipment, plus they take a lot longer to charge up, but this is getting better as technology improves and the infrastructure to support rapid charging expands. Consider electrical options in your decision making.

Hydrotreated Vegetable Oil (HVO)

HVO is a biofuel made from waste vegetable oil processed to make it suitable for use in diesel engines. It is considered a sustainable alternative to conventional diesel on the journey to zero emissions power. When compared with diesel combustion it leads to reduced GHG emissions, coming from renewable feedstocks, and can reduce NOx and PM emissions by up to 18% and 66% respectively.[8] It adheres to both the EN15940 standard for paraffinic fuels and ASTM D975 the standard for diesel fuels. Hence it is known as a 'drop in' fuel – you don't have to flush or clean the engine before use, and many engine manufacturers now warrant its use. Whilst it brings these benefits, HVO is very much seen as a short to medium term solution whilst development and roll out continues of low emission, alternatively powered plant, such as hybrid, electric and hydrogen, as the long-term replacements for diesel.[9]

Cleaner burn

Lower GHG and AQ emissions

Drop in fuel for conventional diesel

Hydrogen Fuel Cells

Hydrogen fuel cells are now being used and are seen as a clear alternative. But they are still an emerging technology and are expensive in comparison with more conventional fuels. Be careful as not all sources of hydrogen gas are the same. It can be produced from cracking fossil fuels – so called 'blue hydrogen'. While you have no local AQ emissions when consumed in a fuel cell, overall, it does not reduce the impact on the climate as fossil fuels are still being consumed. Much better is 'green' hydrogen,

Zero GHG and AQ emissions in use and potentially in production

Quieter running

[8] Particulate number and NOx trade-off comparisons between HVO and mineral diesel in HD applications, Bohl et al., Elsevier, 2018, https://epubs.surrey.ac.uk/845538/1/1-s2.0-S0016236117314151-main.pdf

[9] Red-marked fuels for off-road use are currently taxed at 11.14p per litre. This applies to both "red diesel" and "red HVO". From April 2022, the construction sector will no longer be able to get this rebate and will have to use conventional "white diesel" or "white HVO", both of which are taxed at 57.95p per litre. Whilst HVO currently has a price premium compared to diesel, the benefit it brings is in lower GHG, NO_x and PM_{10} emissions and can be seen as a route to more sustainable operations.

which is manufactured using renewable energy to electrolyse water to produce the hydrogen. Prices are currently high compared to other forms of fuel and the necessary infrastructure and availability of suitable kit is still nascent. However, this is truly zero carbon with no GHG emissions or local AQ pollutants, especially at the larger, heavier end of NRMM.

Case Study: Green D+ HVO

Highway maintenance contractor Carnell piloted the use of Green D+ HVO fuel with plant hire firm Speedy. They replaced their regular diesel usage with the HVO fuel to power lighting equipment and the site compound for a Highways England central barrier upgrade on the M6. The scheme, which spans six kilometres, has used more than 4,300 litres of the renewable fuel and confirmed a 90% reduction in CO_2e emissions compared to diesel fuel use.

https://www.theconstructionindex.co.uk/news/view/carnell-to-expand-hvo-fuel-use-after-speedy-trial

Case Study: HVO carbon savings

John Sisk & Son delivered a scheme in Cambridgeshire that successfully used over 1.5 million litres of HVO as an alternative to gasoil to fuel the earthworks plant and equipment needed to build the 5km of highway and create future development areas. This approach saved over 4550 tonnes of CO_2e, a 91% reduction on what would have been generated otherwise. The approach also resulted in an 80% reduction in harmful particulate matter and a 50% reduction in sulphur oxide emissions.

https://www.johnsiskandson.com/uploads/pdf/John-Sisk-Son-2030-Sustainability-Roadmap.pdf

Case Study: Hydrogen powered generators
Mace is collaborating with AFC Energy, a supplier of hydrogen power generation technologies, to replace their diesel power generators with hydrogen power. In line with Mace's ambition to achieve a 10% year-on-year reduction in carbon emissions from its operations and complete removal of diesel generators from their sites by 2026, the first system will arrive on site in early 2022. https://www.theconstructionindex.co.uk/news/view/mace-promotes-hydrogen-powered-generators

Section 3: Beyond the Equipment

3.1 Planning and specifying

	Application	Benefit
It is important that the project's needs are assessed early on to understand what equipment will be needed and where it will be used, so that appropriate machinery can be specified and chosen accordingly. For example, if works are being carried out down a narrow and built-up street, solar power might not be suitable, and a narrow street is more likely to trap bad air fumes and slow their dispersal. Likewise, works near residential areas should be as quiet as possible. For welfare, consider how many people will be using the equipment – whilst this may seem obvious, it will mean the right size and facilities for those using it and, wherever possible for static equipment, look for a grid connection.	Early assessment of project needs	Appropriate equipment identified
When procuring the equipment, incorporate key sustainability questions and criteria into the tender discussions, aligned to your organisation's strategic ambitions for sustainability. This will help to secure the right equipment for the works at hand so that they can contribute to your sustainability goals, leading to reduced emissions, as well as cost reductions. If it is appropriate, look at framework contracts for an extended relationship, which is beneficial as a lot of the background work on sustainability can be done	Procurement frameworks	Achieving client and organisational sustainability goals Quicker project kick off

when suppliers join a framework. In this way you can move to deciding what equipment you need knowing that sustainability – GHG and AQ – has already been considered.		
Importantly, understand the whole life cost (sometimes called the 'total cost of ownership') when deciding equipment. Think wider than only the upfront hire cost, to also consider the running costs from the use of power or fuel. If you have more efficient equipment, it can lead to lower overall costs as well as reduced emissions.	Whole life cost / Total cost of ownership	Overall lower costs through the lifetime
There must be effective planning for equipment to be delivered to site, to ensure lifting the equipment in place happens easily. For example, there should be space to move and turn, and checks should be undertaken for restrictions such as bollards or underground considerations, as this can impact the choice of equipment and how it is brought to site.	Logistics and planning	Cost and time savings
Look to procure or hire equipment with auto stop / start modes that allow equipment to automatically stop and start according to power demand or lack of operator intervention. Also consider other impacts, such as mercury-free lighting and passive infrared sensors in welfare units to minimise unnecessary usage.	Eco-modes	Reduced noise, GHG emissions and costs
Finally, consider the necessity of rebranding, especially when the equipment is not used for a significantly long time period.	Not branding equipment	Waste and cost savings

3.2 Training

	Application	Benefit
For all equipment, guidance and training on the correct ways in which to use equipment is critical. It is strongly recommended that the user of the equipment makes enough time available for their staff to properly learn from the hiring company how to optimise the use of the equipment. It is in their best interest too, as it will ultimately save on operational cost and any potential downtime from incorrect use. Most plant and equipment providers have training materials, such as videos or user guidance.	Effective training for appropriate personnel	Increased productivity, reduced downtime

3.3 Operation

	Application	Benefit
Ensure that, where they are available, low power modes are engaged, users know what they are for and that equipment idling is avoided through operator training. For welfare units, ensure that the power management is used to balance peaks and troughs of demand. For example, make sure that overnight maintenance is switched on, so they run on electric rather than switching to diesel.	Eco-modes	Reduced noise, GHG emissions and costs
As a mandatory requirement, all NRMM must have stage approval plates that provide information on the engine rating.[10] As best practice and going above the minimum requirements, the CESAR Emissions Compliance Verification (ECV) scheme makes it easy to quickly identify the emissions stage of a machine as well as other important supporting information, through the use of clear coded labels and an online database.[11]	CESAR Emissions Compliance Verification scheme	Increased productivity and reduced downtime

[10] Non-Road Mobile Machinery Practical Guide V4.0, Mayor of London, September 2020, https://www.london.gov.uk/sites/default/files/nrmm_practical_guide_v4_sept20.pdf

[11] CESAR Emissions Compliance Verification (ECV) scheme, https://cesarscheme.org/ecv.php

Specifically, for HVO, use larger tanks and IBC's (intermediate bulk containers) where possible to encourage fewer larger deliveries, ensuring that deliveries are planned at the optimum time to remove multiple small loads. Accurately order volumes to reduce fuel wastage, and work with companies whose delivery vehicles also run on HVO.	Fuel delivery	Reduction in delivery GHG emissions and reduced spillage risk

Case Study: Construction company fined £64,000 for no lifting plan

In 2019, a construction company was operated in an unsuitable position on a slope, with no plan for the lifting operation and no competent lift supervisor. There was also no additional edge protection on a temporary platform high up on scaffolding, as required by regulations to prevent a fall from height. They received a prohibition notice from HSE inspectors, were fined £64,000 and ordered to pay costs of £4,926.

https://www.theconstructionindex.co.uk/news/view/lift-plan-fail-results-in-64k-fine

Section 4: Summary

As you can see there are a variety of power sources and ways to reduce the AQ and GHG emissions from your works and contracts. Products are increasingly coming onto the market that state they have lower emissions. Indeed, it is fast becoming one of the selling points, alongside machine operability and service value.

It is important to remember that there isn't one single solution. It will depend on a number of factors including the level and frequency of power that you need, the activity you are undertaking, the location and time of year, as well as who your neighbours are. And let's not forget budget and product availability of course.

Taking all these factors into account means you can use the information in this guide to have a more informed conversation with your plant hire partner to understand what is the right piece of kit for the tasks at hand, whilst also enabling you to contribute to reducing AQ and GHG emissions.

Appendix

Additional Resources:

1. Plant Category Group Minimum Standards, Supply Chain Sustainability School, July 2019 https://www.supplychainschool.co.uk/wp-content/uploads/2019/10/Plant-category-Group-briefing-1019-final.pdf

2. Non-Road Mobile Machinery (NRMM) Practical Guide, Greater London Authority, September 2020 https://www.london.gov.uk/sites/default/files/nrmm_practical_guide_v4_sept20.pdf

3. Non-Road Mobile Machinery Certification. This is a 'live' document of currently approved products. Therefore, products can lose approval, or new ones can be added. If a retrofit loses approval, there is a one year grace for those who bought the products, and then after one year they are deemed non-compliant. https://energysavingtrust.org.uk/service/non-road-mobile-machinery-certification/

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