

Consultation Draft: Zero diesel sites route map

CLC Zero diesel sites working group



Construction
Leadership
Council

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The diesel challenge

The UK has made the commitment to be carbon net zero by 2050. For the construction industry this will include reducing and eliminating the sector's use of diesel¹, the dominant fuel in construction across the UK and accelerating alternative solutions.

It is estimated that there are over 300,000 items of Non-Road Mobile Machinery (NRMM)² in use across the UK construction sector. In addition to this, many construction sites require on-site power generation which typically uses diesel generators ranging from 10kVa to 500kVa. In 2020, UK construction used 2.5 million tonnes of oil equivalent (Mtoe) of diesel on sites³, emitting huge volumes of carbon dioxide equivalent (CO₂e), which includes CO₂ and other greenhouse gases found in machine emissions. Key NRMM used across the construction sector include those listed in figure 1 (right).

Product	Carbon emissions (kg CO ₂ e/year)
Telehandlers	<i>To be confirmed following consultation with industry</i>
Excavators	
Mini excavators	
Dumpers	
Rollers	
Wheeled loaders	
Cranes	
Forklift Trucks	
Piling rigs	
Generators	

Figure 1: Key NRMM used across the UK construction sector

In addition to the carbon consequences of this use, diesel used in construction also has an impact on local air pollution and public health, with emissions linked to causing strokes, heart diseases, lung cancer, acute and chronic respiratory diseases⁴.

As well as NRMM and on-site power generation including welfare and lighting, diesel is also used for the transport of materials and plant to and from construction sites and contributes a further 2.067 Mtoe in diesel consumption.

Standard diesel is derived from crude oil. However, in recent years a number of products with similar characteristics have entered into the UK construction sector as alternatives to diesel. These biofuels, which include Hydrotreated Vegetable Oils (HVO) and gas-to-liquid (GTL) are defined in the Renewable Transport Fuel Obligation (RTFO) as “Fuel made from recently-living biological material”.

Whilst we recognise biofuels offer a potentially beneficial opportunity to reduce carbon in the short-term (through sustainable sourcing), broader action is needed to achieve decarbonisation across the whole construction sector.

1. Where this document refers to 'diesel', it relates to 'fossil' diesel that has been distilled from petroleum fuel oil.
 2. Non-Road Mobile Machinery is a broad category which includes mobile machines, and transportable industrial equipment or vehicles which are fitted with an internal combustion engine and not intended for transporting goods or passengers on roads.
 3. Fuel use by industry groups in the United Kingdom, 1990-2022.
 4. World Health Organisation, Air Pollution Impacts - https://www.who.int/health-topics/air-pollution#tab=tab_2
 5. Renewable Transport Fuel Obligation (RTFO) - <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-rtfo-compliance-reporting-and-verification>

Alternative options include the use of gases such as Liquefied petroleum gas (LPG) and Hydrogen. Hydrogen can be derived from a number of different sources; the table⁶ below highlights the different hydrogen terminologies and technologies available.

Terminology		Technology	Feedstock/Electricity source	GHG footprint*
PRODUCTION VIA ELECTRICITY	Green Hydrogen	Electrolysis	Wind/Solar/Hydro/Geothermal/Tidal	Minimal
	Purple/Pink Hydrogen		Nuclear	
	Yellow Hydrogen		Mixed-origin grid energy	Medium
PRODUCTION VIA FOSSIL FUELS	Blue Hydrogen	Natural gas reforming + CCUS Gasification +CCUS	Natural Gas/Coal	Low
	Turquoise Hydrogen	Pyrolysis	Natural Gas	Solid carbon (by-product)
	Grey Hydrogen	Natural gas reforming		Medium
	Brown Hydrogen	Gasification	Brown coal (lignite)	High
	Black Hydrogen		Black coal	

* GHG footprint given as a general guide, but it is accepted that each category can be higher in some cases. CCUS = Carbon Capture, Utilisation & Storage.
Source: https://www.researchgate.net/figure/The-hydrogen-color-spectrum-and-indications-for-carbon-emissions-11_fig1_358515834⁶

Green Hydrogen is as defined in the UK Hydrogen Strategy⁷ as *hydrogen produced through a process of electrolysis, where electricity is used to split water into hydrogen and oxygen – the gas from this process is often referred to as ‘green hydrogen’ or zero carbon hydrogen when the electricity comes entirely from renewable energy sources*. With the objective of decarbonising the construction industry, the use of ‘green hydrogen’ is a key focus area.

Currently new NRMM being sold in the UK needs to have an engine that meets the EU Stage V emission standard⁸. From 1st January 2023 NRMM (including generators) will require provisional GB Type Approval.

Some authorities and organisations have set minimum air pollution emission standards for NRMM, including the Greater London Authority (GLA) and High Speed Two (HS2) Ltd. Defra is currently considering how these case examples can be extended across the UK.

6. Source: https://www.researchgate.net/figure/The-hydrogen-color-spectrum-and-indications-for-carbon-emissions-11_fig1_358515834

7. UK Hydrogen Strategy - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf - p.8.

8. Cleanest diesel emission standards, unless covered by the provisions for Transition Engines.

On 10 June 2021, a new policy became law in the Finance Act 2021, aimed at supporting the UK's net zero greenhouse gas emission objectives by 2050. The policy's objective aimed to ensure that the tax levied more fairly reflects the harmful impact of the emissions which are produced from diesel. The policy also aimed to ensure the tax system incentivised users of polluting fuels, such as diesel, to improve the energy efficiency, invest in cleaner alternatives and to use less fuel.

From April 2022, the new legislation came into force and the construction industry was removed as a sector entitled to use Red Diesel, requiring all construction activities to pay full 'White Diesel' prices.

The Construction Leadership Council's CO₂nstructZero is the construction sector's industry-change programme leading the sector's acceleration to Net Zero. Construct Zero sets out nine priorities and a suite of 28 metrics against which the sector's progress is measured through quarterly public updates. As well as highlighting process, the reports also shine a light on areas (within the lens of the 28 metrics) where the pace of progress and delivery needs to increase.

The first CO₂nstructZero priority is accelerating the shift of the construction workforce to zero emission vehicles and onsite plant, which is being measured by a commitment to eliminate 78% of diesel plant from construction sites by 2035. This commitment is aligned to the 6th Carbon Budget to cut emissions by 78% across industries by 2035 to meet the UK 2050 Net Zero ambitions.

There is already significant work underway across the UK construction sector to eliminate diesel from construction sites. A number of large clients and contractors are setting commitments to reduce and eliminate the use of diesel from construction.

CO₂nstructZero has established a 'Delivering Net Zero Diesel sites' work-stream to support the co-ordination and the sharing of best practice with the publication of this route map, enabling the wider sector and businesses to understand how they can move to this new model and the benefits of doing so. The workstream has included representatives from manufacturers, plant hire companies, contractors, academia, representative bodies and government, culminating in the publication of this route map.

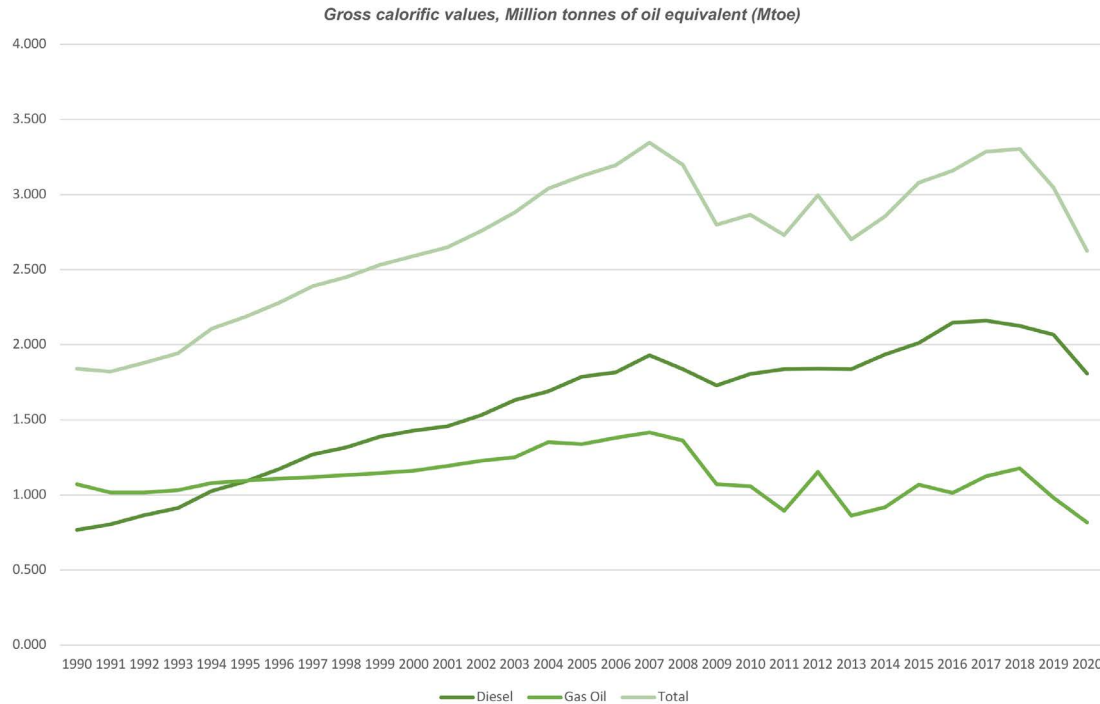
9. <https://www.constructionleadershipcouncil.co.uk/constructzero/>

10. Sixth Carbon Budget - <https://www.theccc.org.uk/publication/sixth-carbon-budget/>

Measuring diesel use

In order to reduce and eliminate diesel use from construction sites, the working group recognised that we first need accurate and representative data on the use and impacts of diesel on UK construction sites.

The group will consult widely across the industry, bringing together evidence on the volume of diesel used across the UK construction sector as the output metric to show annual progress of the route-map implementation. Commentary around alternatives adopted will be provided, along with calculations of carbon savings linked to the BEIS Greenhouse gas reporting: conversion factors¹¹.



ACTION 1 - ZDS Working Group to prepare annual report on diesel use and impact on UK Construction, including assessment of data robustness

Health & Safety of Alternatives

Health and Safety aspects relating to the use of diesel alternatives are under consideration by working groups of the Construction Industry Advisory Committee (CONIAC). Once available, the outputs will be shared with the wider industry.

Should you be interested in being involved in this activity, please contact Paul Reeve, Director of CSR, ECA (paul.reeve@eca.co.uk).

11. BEIS, Greenhouse gas reporting: conversion factors 2022 - <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022>

A Zero Diesel Future

In The Delivering Zero Diesel sites' workstream has identified four main elements that will make up the route-map moving away from the use of diesel:

- **Improving efficiency: Using best practice**
- **Transition to cleaner fuels**
- **Transition to electric**
- **Wider industry support**

For each of these streams there will be a number of required interventions including industry research; policy changes; targets & strategies; technology development; and sector collaboration.

In the following sections we set out the opportunities and challenges associated with each of these elements, the actions that need to be undertaken, along with a proposed timeline for delivery.

Where industry is referred to in the actions below, this refers to the Zero Diesel sites' working group unless additional organisations are noted.

Improving efficiency: using best practice

Improving efficiencies is linked to using the resources we currently have across the construction industry most efficiently. Efficiencies are linked to both improved training and behaviours to the use of technology to reduce fuel consumption on construction sites.

Title	Opportunity	Challenge	Action	Target
Anti-idling	<p>Existing research indicates there is significant non-productive use of diesel on sites where machines are idling awaiting use.</p> <p>The sector can make significant inroads into its current diesel use simply by reducing idling time.</p>	<p>Lack of operator awareness/ interest in reducing diesel use through idling reduction.</p> <p>Operators keeping the engine running to keep warm or cool during weather extremes.</p> <p>Lack of use of existing machine telemetry to manage out idling.</p>	<p>Action 2 - Industry to develop training and publish guidance on anti-idling.</p> <p>Action 3 - Industry fuel-saving 'tournament' to award outstanding performance.</p> <p>Action 4 - Work with key industry bodies to ensure better use of telemetry data (produce case studies on efficiency opportunities.)</p>	<p>Anti-idling guidance (toolkit and video) published by the Supply Chain Sustainability School for use across the construction industry.</p> <p>Companies, submitting data, reporting ≥ 15% idling reduction based on industry average of 45% idling time.</p>
Telematics	<p>It is recognised that there is a lack of industry information to support decisions to convert to alternative power sources for plant.</p> <p>By using telematics, users can get a better understanding of the way each item is operating, and its power requirements. This can support the development of an assessment of 'break-even' to allow the shift to new power sources as soon as is viable.</p>	<p>Lack of operator awareness/ interest in using telematics as a means to reduce diesel use through idling reduction</p> <p>Lack of use of existing machine telemetry to manage out idling.</p>	<p>Action 5 - Industry to develop guidance on the adoption of telematics to support on-site management. Guidance to include power source transition, including options to retrofit telematics to older plant.</p> <p>Action 6 – Consult on the development on a common approach to telematics data capture.</p> <p>Action 7 - Develop databank to provide benchmark data for alternative power options.</p>	<p>Consultation and industry guidance published by end of 2023.</p>
Operator Training	<p>We all play a vital role in securing improved efficiency, whether using plant, buying it or financing its purchase. If there is better information and knowledge about diesel reduction, action to accelerate progress towards zero diesel will be taken.</p>	<p>Lack of consistent guidance for individuals in key job roles about how each contribute towards achieving zero diesel sites.</p>	<p>Action 8 - Industry to develop and delivery training courses and e-learning on zero diesel.</p>	<p>CZ to publish HS2 NRMM management plan for the industry.</p> <p>First training courses to be launched by end of 2022.</p>
Energy Efficient Solutions	<p>Industry can curtail existing diesel use through better management of existing energy use on site. This could include optimising efficiency, or storing surplus energy.</p>	<p>Lack of awareness in the industry of the potential solutions available, how effective alternatives are and what benefits they deliver.</p>	<p>Action 9 - Industry to develop catalogue of case studies including cost-benefit analysis tool.</p> <p>Action 10 - Industry to work with system manufacturers to shape future development</p>	<p>Catalogues published periodically. Case study template to be developed.</p> <p>Industry site efficiency sub-group formed to investigate emerging technologies.</p>

Transition to cleaner fuels

As we transition as an industry away from diesel to cleaner fuels there are a number of opportunities and key challenges linked to the sustainable production, transportation, storage and use of alternatives that we will need to collectively overcome. Better understanding the opportunities available, together with solutions to overcome the challenges will accelerate the decarbonisation of the construction sector.

Title	Opportunity	Challenge	Action	Target
Biofuels	<p>In recent years biofuel alternatives to traditional diesel have become available that potentially offer similar performance with a lower carbon footprint. Transitioning existing plant to biofuels allows early progress towards decarbonisation while other technologies are in development</p>	<p>There are concerns about the sourcing of biofuels (such as HVO), with the wider impacts on crops used to create the fuels.</p> <p>Transportation impacts where sourced globally, may undermine low carbon credentials.</p> <p>While biofuels can deliver reduced carbon emissions, it does not eliminate them entirely. As more companies transition to biofuels this is putting pressure on suppliers, meaning that it is harder to source sustainably.</p>	<p>Action 11 – Signpost existing research on impacts of biofuels, and how to ensure biofuels are sustainably sourced.</p>	<p>100% of biofuels in use across the construction sector independently certified as sustainably sourced by 2025.</p>
Hydrogen (combustible & fuel-cell technology)	<p>Hydrogen offers an important solution for the hard to decarbonised sector of NRMM.</p> <p>Being fast to refuel and portable, it has great benefits particularly in environments where it would be too difficult to provide electricity as an alternative and for machines whose energy consumption outstrips battery electrification.</p> <p>Opportunity to use sustainably produced hydrogen in construction to be explored in particular.</p> <p>The use of hydrogen combustion and fuel-cell generators could reduce emissions and noise creating community benefits.</p> <p>Additional benefits include the ability to retrofit existing NRMM to make it hydrogen enabled, plus the opportunity to share H2 infrastructure with other local end-users.</p>	<p>Further development work required for use of hydrogen as a clean fuels source for construction.</p> <p>Regulatory barriers could potentially limit the use and movement of hydrogen powered plant.</p> <p>Understanding of hydrogen safety issues.</p> <p>Need for high purity hydrogen to be used in fuel cells.</p> <p>Access to hydrogen is currently limited as UK production, distribution and storage capacity for the construction sector is nascent.</p> <p>Workforce reskilling to safely use and store hydrogen on site.</p> <p>Current cost of hydrogen is high but expected to reduce due to hydrogen business model support.</p>	<p>Action 12 - Industry to support existing work, and liaise with BEIS and DfT, to develop hydrogen as a fuel source for NRMM whilst removing legislative barriers such as Road Vehicle (C&U) Regulation 1988 (DfT) and the Written Scheme of Examination requirements every time a machine moves site (BEIS/ HSE).</p> <p>Action 13 - Industry to work with existing fuel suppliers to ensure they will be able to meet demand early and have realistic plans to deliver low carbon hydrogen to site.</p> <p>Action 14 - Industry to develop guidance with HSE on the safe delivery, management, and use of hydrogen on site.</p>	

Transition to cleaner fuels

Title	Opportunity	Challenge	Action	Target
Other cleaner fuels (GTL, LPG, Glycerine, etc)	Alternative cleaner fuels to traditional diesel have become more widely available, offering similar performance with a lower carbon footprint. Transitioning NRMM will allow early progress towards decarbonisation.	Understanding safety issues linked to transport, storage and use on construction sites. Lack of awareness of alternative solutions in industry. Challenges around the reliability of alternatives, and the viability for use in existing NRMM.	Action 15 - Industry to develop guidance with HSE on the safe delivery, management, and use of hydrogen on site Action 16 – Work with key industry bodies to demonstrate technologies in construction to develop evidence of alternatives.	Publication of safe site information by 2023.

Transition to electricity

Construction site electrification is crucial to achieving zero-diesel construction sites. This transition from diesel generators to cleaner fuels and mains power electricity will facilitate the use and roll out of cleaner technologies across the industry.

Title	Opportunity	Challenge	Action	Target
Early wins	While electrification of much of the plant used by the construction sector may take time to develop/adopt technologies, there are aspects of construction sites that could readily be converted to electricity (e.g site welfare and power generation).	Lack of awareness of alternative solutions in industry. Potential cost/technical implications of using electrical alternatives. Understanding of electrical safety issues relating to the various options.	Action 23 - industry to prepare a checklist of site equipment where performance of electric alternatives to diesel are already viable and market available.	Initial checklist of diesel equipment electric alternatives published by end of 2022, to be updated annually. Publication of site safety information by 2023.
Securing grid connections	The transition to electricity as a main power source for construction sites can be accelerated if projects have sufficient access to the grid, with the capacities required to meet demand, from day one. Through deploying energy efficiencies, construction site energy demands can be reduced making mains grid connection cheaper and quicker.	Industry report very significant challenges in securing grid connections to sites. Understanding required technical and safety considerations, to enable practical uptake of electrical alternatives.	Action 23 - Industry to engage with distribution network organisations (DNOs) to set out a process to achieve/follow prompt provision of temporary and/or permanent grid connections for construction sites/developments.	Published guidance on process to follow to gain grid connections by 2023. Where mains power connections can be achieved, target 100% renewable energy tariff. Publication of site safety information by 2023.

Transition to electricity

Title	Opportunity	Challenge	Action	Target
Removing diesel generators	One very visible opportunity to drive out diesel is its use of site generators. Removing diesel generators from site could provide an early boost to plans to cut carbon.	Difficulties in securing suitable alternatives to diesel generators, including access to grid electricity or technology to support alternative fuel sources.	<p>Action 17 - Industry to develop a commitment for companies to phase out diesel generators on site.</p> <p>Action 18 - Develop guidance and support to help businesses through the progression.</p>	Target 500 companies signed up by the end of 2023 to phase out diesel power generation by 2025.
On-site renewable generation	<p>For some sites securing grid connections can be difficult or impossible. As such, the only alternative if electricity is going to be used on site is for on-site generation.</p> <p>Some level of supplementary energy supply may be possible.</p>	<p>It is difficult to match heavy demand from construction plant to the likely electricity supply that can be generated on site.</p> <p>Space requirements and location constraints may be a challenge within urban areas.</p>	<p>Action 19 - Industry to support existing work ongoing to look at on-site generation and roll out the learnings.</p> <p>Industry to signpost good practice, and suppliers of renewable electricity generation technology.</p>	<p>Increase in construction power use from renewables, targeting year on year increase using 2022 as a baseline.</p> <p>Publication of site safety information by 2023.</p>
Developing battery-electric plant	Recent years have seen significant advances in the quality of batteries that are available to store energy and power construction plant. There is the opportunity to harness these advances to replace diesel within certain plant, and to provide/optimize storage and delivery of site energy when needed.	The power intensity of much construction plant means that battery requirements would be significant. Battery power is also reliant on sufficient access to electricity for recharging as well as allowance for charging times	Action 20 - Industry to support existing groups efforts to develop battery powered alternatives to diesel for construction plant.	<p>Increase in construction plant power that is battery-electric over diesel, targeting year on year increase using 2022 as a baseline.</p> <p>Publication of site safety information by 2023.</p>

Wider industry support

Collaboration across industries and sectors is essential in achieving our decarbonisation ambitions. Through sharing lessons learnt and opportunities ambitions for diesel-free construction will be accelerated.

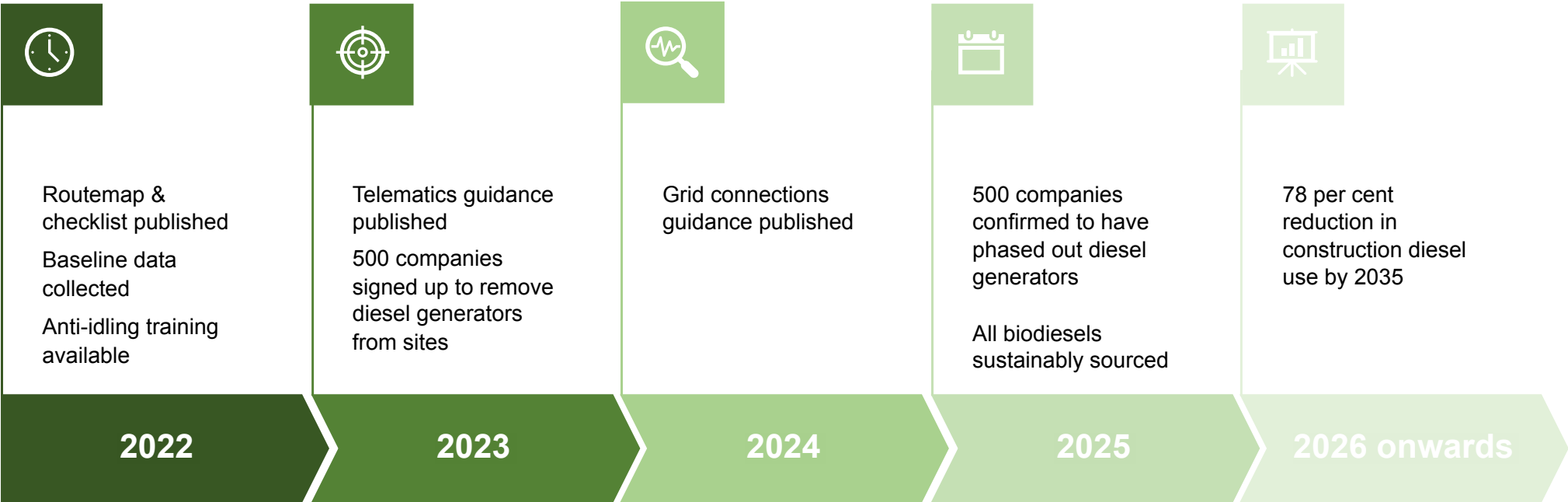
Title	Opportunity	Challenge	Action	Target
Zero diesel strategies	<p>Each business in our sector can play their own individual role in the drive towards zero diesel construction sites.</p> <p>Companies can put in place plans for how they will eliminate diesel based on their own specific requirements and challenges.</p>	<p>Many companies including SMEs will struggle with where to start in terms of developing a strategy for zero diesel, with significant volumes of potentially conflicting information from multiple sources.</p>	Action 21 - Industry to develop a template zero diesel sites plan and checklist, along with case studies to demonstrate how businesses can move toward zero diesel.	500 companies with signed off zero diesel plans published on the CLC website by 2024 10% annual growth in number of published strategies.
Cross-Whitehall group on diesel reduction	<p>The UK government is the single largest buyer of construction services in the country. As such it has huge power to drive change in relation to diesel elimination.</p>	<p>There is currently no single coordinated plan for this elimination for the UK government and its executive agencies, nor for the wider public sector.</p>	Action 22 - Industry to explore opportunity to promote the development of a UK Government diesel elimination strategy for public sector construction.	Subject to approval, public sector diesel elimination strategy for construction published by 2024.

CO₂nstructZero 2022/23 Priority Actions

CO₂nstructZero will be publishing the following resources, as new good practice, to assist the industry during this initial period of diesel elimination, whilst the group progress the remaining actions:

- **Template Diesel Action Plan:** a sample document template that can be filled in by businesses to create a diesel reduction action plan for their own business
 - **Anti-Idling tool-box talk video and slide pack:** a six minute video and supporting material highlighting the 'why' and 'how' to support every construction site in the UK reduce its idling and increasing its efficiency - saving money and carbon with no upfront investment!
 - **Non-Road Mobile Machinery Management Plan;** a guide for the whole industry on everything from selecting the right plant for the job to the latest viable alternative.
 - **Diesel-status matrix template** to define site baseline fuel use to prioritise areas for improvement / innovation.
 - **A series of in use 'proven' case studies** for the latest machinery efficiency and alternative options. To support the NRMM Management Plan, these will be web-based and continually updated as new innovation development become the new industry norm.
 - **Performance of existing and emerging power sources.**
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CO₂nstructZero Timeline



Zero Diesel Site Working Group Members

The following organisations have been involved in the Zero diesel site working group:

- Alun Griffiths
- Anglian Water
- BAM Nuttall
- Barhale
- Department for Business, Energy & Industrial Strategy
- BE-ST
- Civil Engineering Contractors Association (CECA)
- Construction Employers Federation, Northern Ireland
- Construction Equipment Association
- Construction Plant-Hire Association
- ECA (engineering / electrotechnical services)
- Enable Hire
- FM Conway
- Graham
- HS2
- Imperial College London
- Jackson Civil Engineering
- JCB
- JM McCann
- JN Bentley
- Keltbray
- Kier
- Laing O'Rourke
- Lendlease
- Lower Thames Crossing
- Morgan Sindall
- National Highways
- Select Plant Hire
- Speedy Services
- Sir Robert McAlpine