Milwaukee®

Nothing but **HEAVY DUTY.**™

THE ROLE OF CONSTRUCTION IN CREATING A SAFER, GREENER FUTURE.

FOREWORD

At MILWAUKEE, we have been leading the innovation in battery powered tool technology for over a decade. The ability to find solutions that will keep up with the demands of our end-users, whilst reducing emissions, is imperative to long-term sustainability.

We are glad to see the push towards reducing the environmental impact of construction spreading across our industry. As the detail in this paper highlights, it is essential that we work collectively to minimise emissions at every point of the construction process.

Every petrol or generator powered tool we can remove from a jobsite is a positive step forwards in reaching the Net Zero target. With the correct innovations in place, we believe this can be done whilst improving the productivity and safety of those working on jobsites throughout the country.

Dale McElveen
General Manager - Milwaukee Tool UK

INTRODUCTION

The need for a safer, greener, more productive future for construction

The growing climate crisis

“Climate Change is the defining issue of our time, and we are at a defining moment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale”.

This stark warning from the United Nations is a reminder of the urgent need to take action. If we are to prevent catastrophic climate breakdown, every single activity that contributes to global warming needs to be addressed, including the elimination of emissions from construction plant hire equipment and machinery.

This white paper outlines the benefits to be had from switching to zero emission plant hire equipment. Its intention is to inform and support developers, public authorities and major contractors to change their procurement methods and construction operations to embrace zero emission technology.

Construction’s impact on air and noise pollution

There is no safe amount of air pollution. In London, for example, the construction industry is estimated to contribute 7%, 34% and 15% respectively to NOX, PM10 and PM2.5 emissions (LAEI 2106). Emissions from fossil fuel-powered construction tools and machinery make a significant contribution to these totals.

Construction noise too is a major issue. Site-based processes such as cutting, drilling and grinding all produce noise, as do the engines that power the tools used for these tasks. While engine noise levels are generally lower than the tools in operation, engine noise is likely to occur over a prolonged period, which in itself can be an annoyance to those on site and people living nearby. Even low levels of noise can present a health hazard when exposure occurs over a long period of time.

> “Climate Change is the defining issue of our time, and we are at a defining moment”

Injuries on the job site

Trip hazards are a major source of accidents on construction sites. Of the 61,000 self-reported non-fatal injuries to construction workers each year, 26% of construction accidents are attributable to slips, trips or falls on the same level, which includes those tripping over power cords or compressed air hoses to plant hire equipment where these have not been properly secured.

Driving productivity reforms

Construction needs to embrace new technology in order to reinvent itself. The elimination of fumes and emissions from plant hire equipment has the potential to increase productivity by enabling operatives to work indoors, in trenches and in tunnels without having to deal with emissions from fossil fuel-powered plant.

In addition, the silent power of electric plant hire equipment will help to reduce overall site noise levels, which may even enable the working day to be extended and increase productivity still further.

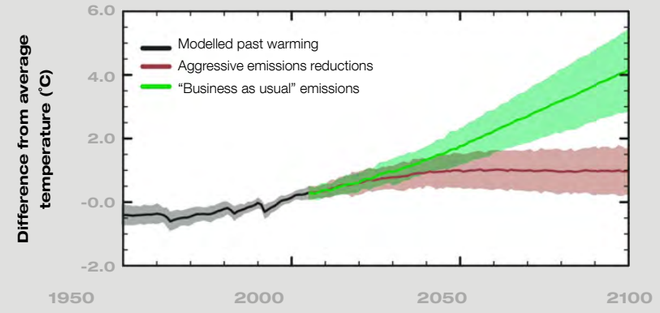
The need for change

Contractors that fail to tackle emissions from construction sites may find it increasingly difficult to bid for projects. The Norwegian city of Oslo, for example, has made it a requirement for all public construction sites to operate using zero emission machinery and have zero emissions from the transport of materials and workers to site. From 2025, all public works in the city are to be fossil fuel free. Other cities are soon expected to follow Oslo’s lead. Contractors that fail to embrace zero emissions plant hire equipment may even miss out on the opportunity to bid for large municipal projects.

To find out more about Milwaukee’s zero emissions range of plant hire equipment go to milwaukeetool.co.uk/systems/mx-fuel

Global average surface temperature change

Source: “Climate Change Evidence & Causes: Update 2020” - The Royal Society



CHAPTER 1

The dangers of construction emissions

Introduction

Air quality matters. Air pollution harms the environment and our health and wellbeing.

Globally, the construction industry produces 23% of the world's total CO2 emissions across its entire supply chain. According to environmental action group Bellona, over 5% of these are related directly to activities on construction sites "predominantly through the combustion of fossil fuels to power machinery and equipment".

Air pollution plays a key role in the process of climate change, which places our food, air and water supplies at risk, and poses a major threat to our health. Several pollutants that cause this environmental damage are also toxic to our bodies. Therefore, many of the changes that would decrease air pollution to protect our health – especially using energy more efficiently and burning less solid fuel and oil – would also help to slow down the overheating of our planet.

Critically, construction emissions are more likely to occur in urban areas where air pollution is already likely to be a problem. That means that any decrease in construction emissions will help improve the air quality in towns and cities for the benefit of their citizens, but it will also help minimise the impact of climate change to leave a healthy planet for future generations.

What is air pollution

Air is polluted when noxious gases and tiny particles are emitted into the atmosphere which can have an impact on human health. These emissions can be from both natural or manmade sources.

Natural sources of air pollutants include volcanic eruptions, windblown dust and emissions of pollen and spores and volatile organic compounds from plants, according to the European Environment Agency.

Manmade emissions primarily result from the combustion of fossil fuels including oil, petrol and diesel as well as dust generated through activities such as demolition and construction. The main pollutants of concern to health are carbon monoxide, nitrogen dioxide, ground level ozone, particulates, sulphur dioxide, hydrocarbons and lead.

Long-term exposure to low levels of air pollution can still have harmful effects on health, just as short term exposure to high levels of pollution can have an immediate health impact. The WHO is clear that there is no such thing as a safe level of exposure to air pollutants, since any exposure will impact health.

> **"Globally, the construction industry produces 23% of the world's total CO2 emissions across its entire supply chain"**

The main pollutants

CO

Carbon monoxide is produced when fossil fuels burn without enough oxygen. It is poisonous when inhaled because it combines with haemoglobin, the oxygen-carrying substance in red blood cells. Workers can be exposed to carbon monoxide when using petrol powered equipment in enclosed spaces.

NO2

Nitrogen dioxide is a gas produced during the combustion of fossil fuels. Short-term exposure to concentrations of NO2 can cause inflammation of the airways and increase susceptibility to respiratory infections and to allergens.

Ozone

Ozone is found naturally in the atmosphere. Most ground-level ozone is a secondary pollutant formed by the action of sunlight on volatile organic compounds in the presence of nitrogen dioxide.

Sulphur dioxide

Sulphur dioxide is a colourless, nonflammable gas with a penetrating odour that irritates the eyes and air passages. The most common sources of sulphur dioxide include fossil fuel combustion.

Hydrocarbons

Hydrocarbon volatile organic compounds include methane and benzene. Methane contributes to global warming and ground level ozone. 80% of man-made emissions of benzene come from petrol engines. Benzene causes harmful effects on the bone marrow and a decrease in red blood cells. It can also cause excessive bleeding and affect the immune system.

Particulates

Some estimates have suggested that particulates are responsible for up to 10,000 premature deaths in the UK each year. A major source of particulates are combustion engines, which produce particles when fuels are burned or lubricants used up in the engine.

Construction emissions

Fossil fuel powered construction tools and machinery are a significant contributor to air pollution. particularly in urban areas where poor air quality is already a problem. A DNV GL report commissioned by Oslo's Climate Agency, estimates that the total annual greenhouse gas emissions from construction sites in C40 cities (the network of 40 of the world's megacities committed to addressing climate change) is estimated to be in the range of 120 to 240 million tonnes of CO2e.

An analysis of CO2e emissions from construction sites in Oslo estimates that approximately 7 % of the city's total CO2e emissions is related to construction sites. In London, the construction industry is estimated to contribute 7%, 34% and 15% respectively to NOX, PM10 and PM2.5 emissions (LAEI 2106).

There is no safe amount of air pollution. Yet it is impossible to eliminate emissions of air pollutants whilst burning fossil fuels in generators, compressors and petrol powered tools and grinders. While construction machinery continues to be fueled in such a way, their use will continue to impact the health of workers on the site and people working or living nearby.

Air pollution affects people throughout their lifetime

Source: Public Health England

Pregnancy

- Low birth weight

Children

- Asthma
- Slower development or lung function
- Development problems
- More wheezing and coughs
- Start of atherosclerosis

Adults

- Asthma
- Coronary heart disease
- Stroke
- Lung cancer
- Chronic obstructive pulmonary disease (as chronic bronchitis)
- Diabetes

Elderly

- Asthma
- Accelerated decline lung function
- Lung cancer
- Diabetes
- Dementia
- Heart attack, heart failure and strokes

Health impacts of construction emissions

Air pollution is harmful to everyone. It is one of the major environmental determinants of health. The degree of certainty about health effects varies by pollutant and disease.

The health problems caused by air pollution impose many costs on society through reduced productivity and an added burden on the health service. Overall, the estimated cost to individuals and society is more than £20 billion annually for the UK.

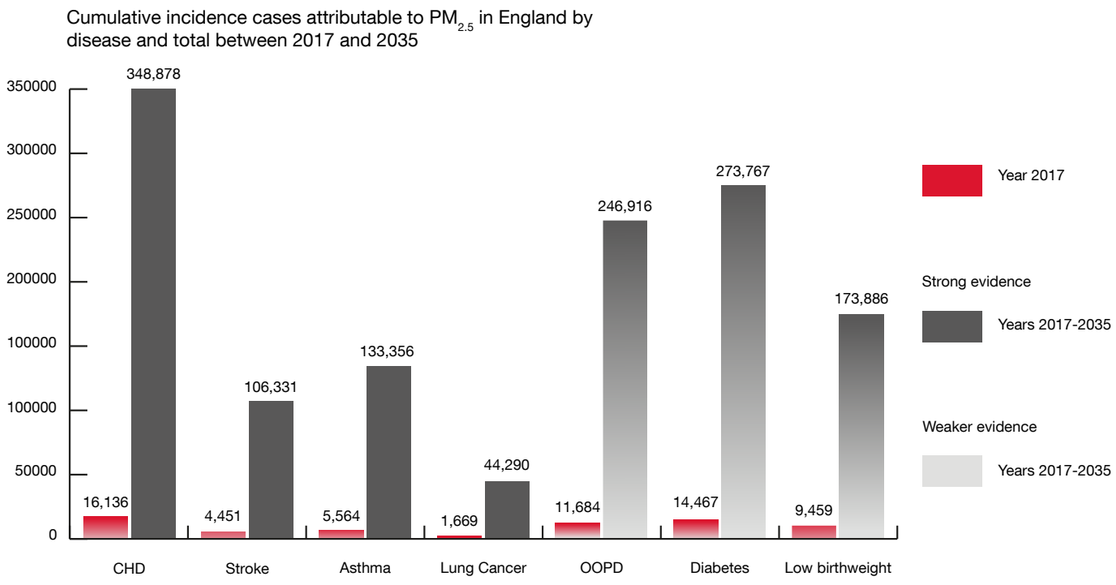
Health risks arising from air pollutants on construction sites can be appreciably higher than those of the same pollutants occurring in the domestic situation, as exposure concentrations can be substantially higher. What's more, workers in construction may find it difficult to reduce, or to materially influence their exposure to harmful inhaled agents, because of their reliance on the employer to provide tools and equipment, such as fossil fuel powered plant.

The numbers of construction workers harmed by air pollution are large. Rather than obsess in trying to define the exact number of deaths and illnesses, there is already sufficient information on the need to act. For PMs and nitrogen oxides from combustion, the evidence is easily good enough to be confident that reducing emissions will be beneficial for many people.

What's more, the pollutants primarily responsible for damage to health often share common sources with the toxic pollutants that damage the climate. When we burn fossil fuels to power plant and equipment, health-damaging chemicals (notably SO2, oxides of nitrogen including NO2, and PM) are released. At the same time, fossil fuel combustion produces gases such as CO2 and NO2, which contribute to warming of the planet. One consequence is that measures to reduce emissions of greenhouse gases through energy efficiency, and most of the options for switching from fossil to other fuels, also reduce local air pollution with immediate benefits to health.

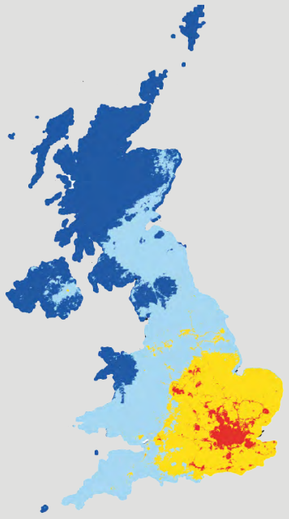
Conditions associated with exposure to PM2.5

Source: Public Health England



Scale of the problem

Source: Public Health England



PM2.5 background concentration

Annual mean (µg m3)

- 0.0 - 5.0
- 5.1 - 8.0
- 8.1 - 10.0
- >10

Over the following 18 years a 1 µg/m³ reduction in fine particulate air pollution in England could prevent around:

50,900
cases of coronary heart disease

16,500
strokes

9,300
cases of asthma

4,200
lung cancers

CHAPTER 2

The dangers of construction noise

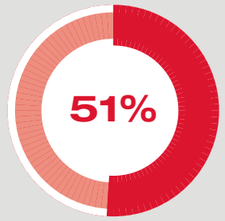
Introduction

Long-term exposure to noise has significant health impacts. On the basis of World Health Organisation information, the EEA estimates that such exposure causes 12,000 premature deaths and contributes to 48,000 new cases of ischemic heart disease (caused by a narrowing of heart arteries) per year across Europe. According to the WHO, these health impacts start to occur below the reporting thresholds set by the EU Noise Directive so these numbers are likely to be underestimated.

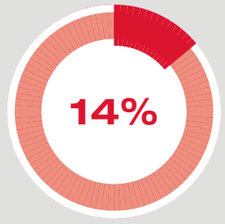
The Control of Noise at Work Regulations 2005 in the UK sets out the requirements of construction sites to minimise the exposure to noise for workers to avoid ill-health. There is also the requirement to ensure that nearby residents are not left harmed by noise from the site.

Noise from construction processes

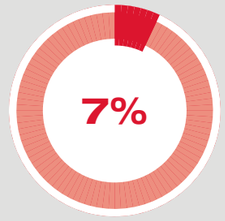
The statistics from the National Institute for Occupational Safety and Health (NIOSH) make for grim reading:



of all workers in construction have been exposed to hazardous noise

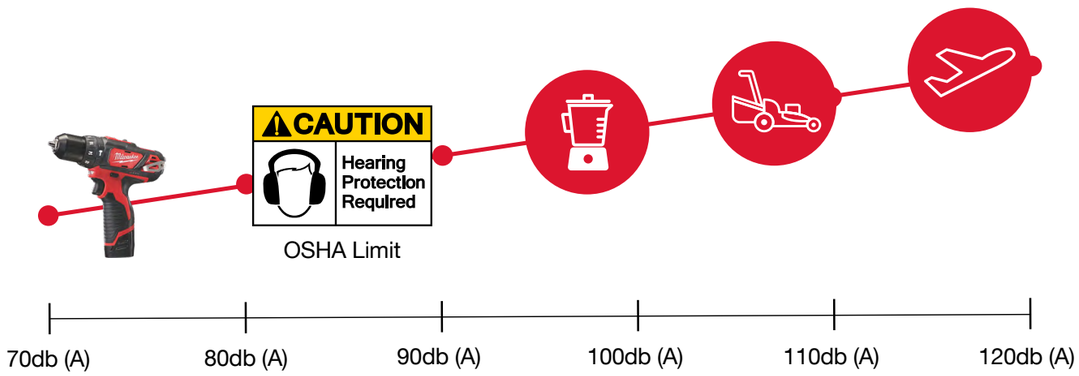


of all construction workers have hearing difficulty



of all construction workers have tinnitus

Decibel sound scale



HSE classifies the construction industry as a high risk industry for noise related ill health. Many construction processes are noisy. According to the HSE, if you have to raise your voice to have a normal conversation when standing about 2 metres apart, for at least part of the day, then noise levels on the site may be at a level which could damage health.

The HSE also regards high levels of noise from plant and plant tools as hazardous. Its advice is to select quietest tools and equipment that are effective for the job when buying or hiring plant tools by comparing noise levels from the manufacturer or supplier.

> **“HSE classifies the construction industry as a high risk industry for noise related ill health”**

Noise from engines

Site-based processes such as cutting, drilling and grinding all produce noise as do the engines that power the tools used for these tasks. Unlike impact noise, engine noise is constant, which presents a health hazard when exposed for long periods of time.

Some impacts on hearing can be the result of prolonged exposure to ‘ear-safe’ levels of noise. This can be the case for construction workers, who are in the daily presence of noisy fossil-fuel powered machinery. This can impact cardiovascular function (hypertension, changes to blood pressure and/or heart rate), changes in breathing, annoyance, sleep, physical health and mental health.

Engine noise can also affect operations on the construction site by making it difficult to communicate, which can lead to operator mistakes.

While engine noise levels are generally lower than that of most tools in operation, engine noise is likely to occur over a prolonged period which in itself can be an annoyance to those on site and people living nearby.

Noise impact on the surrounding environment

Noise pollution includes the noise from a construction site that can disrupt people outside of the site boundary. For example, maintenance and refurbishment might be undertaken on a site within an occupied building that others are also using. In addition, noise travels in the open; this can cause noise problems with neighbours when using plant tools on exposed floor plates on high-rise buildings.

Legislation restricts site working hours to limit the impact of noise pollution on nearby residents. Breaches of the rules can result in costly delays and delays to the construction programme.

The hours when noisy work can be carried out varies with Local Authority. Generally, construction work, particularly the use of noisy machinery, is restricted to: Monday to Friday 8am to 6pm and Saturdays 8am to 1pm. Work can still be carried on outside of these hours but not with noisy equipment.

How can site noise be reduced?

Many fossil fuel powered construction tasks, tools and equipment can produce high noise levels. If hiring a tool, the HSE recommends selecting low-noise tools and equipment; its advice is: “don’t buy or hire a problem if you don’t have to”.

Battery powered plant tools make a lot less noise and have a lot less vibration and when compared to direct petrol-driven alternatives. Reducing the noise of plant tools and equipment can have a positive effect on site operations by reducing the likelihood of operator miscommunication.

Eliminating the need for an engine on plant tools, and using battery power can drastically reduce noise levels and potentially increase the number of hours in a the day where machinery can be used. Some manufacturers, like Milwaukee Tool, conduct product sound power tests in hemi-anechoic sound chambers to advance product design. For instance, the battery power of the MX FUEL™ Backpack Vibrator has a noise level of just 92.9dB(A), whereas a petrol engine backpack vibrator was found to have a much higher noise level of 101.9dB(A).

Reducing the noise on a construction site will also reap benefits to society as a whole, by improving work conditions, reducing noise-induced health impacts, minimising the site’s impact on its neighbours and generally creating an all round better environment.

CHAPTER 3

The challenge of working sustainably and safely

Introduction

Sustainable construction is crucial if we want make developments work for ourselves, future generations and to help prevent an environmental crisis.

The definition of sustainability most commonly used was established by the Brundtland Commission back in 1987, which is: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

The definition implies that a we need to look after the planet, its resources and its people to be sustainable. It is widely accepted that for a business to be sustainable there must be a balance between economic, social and environmental factors.

> “Environmental sustainability is about living within the means of our natural resources without polluting the planet for future generations”

Environmental sustainability

Environmental sustainability is about living within the means of our natural resources without polluting the planet for future generations. That means using construction processes that are more environmentally friendly.

One of the biggest environmental challenges for the construction industry over the next decade is to reduce emissions across all stages of construction to help meet government emissions targets.

Every single construction activity which helps to eliminate greenhouse gases makes a contribution in helping prevent global climate breakdown, This includes emissions from fossil-fuel powered plant hire equipment. Since most construction sites are in urban areas, cutting emissions from plant hire tools will help ease the situation in towns and cities where pollution levels may already be high.

It is impossible to eliminate the emission of air pollutants while burning fossil fuels to power plant hire tools. However, by switching to battery powered plant hire tools, which have zero emissions at their point of use, contractors can help deliver environmental sustainability. Of course, battery powered tools still need to be charged so the provenance of the electricity supply will have a bearing on total attributable emissions. However, this will be minimal if the electricity used is from renewable sources or from a green tariff.

Social aspects of sustainable construction process

Creating safe conditions on site and in the surrounding environment is fundamental to achieving good social wellbeing.

Exposure to noise is a health hazard for construction workers. Hearing loss accounts for approximately 10% of compensation for occupational diseases in the European Union. According to the European Agency for Safety and Health at Work, tinnitus is a common hearing dysfunction resulting from prolonged exposure to noise. The agency warns that some impacts on hearing can even result from prolonged exposure to ‘ear-safe’ levels of noise.

Noise does not just harm a worker’s hearing it can also interfere with communication. Workers wearing hearing protection may not be able to hear verbal instructions and warnings, which can cause of accidents and affect operations on the construction site.

Construction sites can generate many different types of pollution but the main concerns for human health are ultra fine particulate matter (PM) and nitrogen dioxide gas. On site, these pollutants are generally produced by the diesel engines in static machines, such as power generators and off-road machinery. Exposure to engine exhaust fumes has been linked to Chronic Obstructive Pulmonary Disease (COPD).

In addition, construction workers are exposed to higher levels of risk when working on sites near machines or with machines that incorporate power cables and/or air and hydraulic hoses. Of the 61,000 self-reported non-fatal injuries to construction workers each year 26% of construction accidents are attributable to slips, trips or falls on the same level. This figure will include those tripping over power cords or compressed air hoses to plant hire tools that have not been properly secured.

The benefit of zero emission plant hire equipment is an site environment with cleaner air to breathe, less noise pollution and tools with fewer vibrations. And, when battery-powered plant hire equipment is used, the potential trip hazard of power cables and hoses is also eliminated.

Of course, in addition benefiting workers a better work environment will also benefit employers and workers’ families by enabling workers to enjoy healthier lives which, ultimately, means they can be more productive and more likely and able to stay in a job for longer. The quality of work will also be higher when the work environment is safe, comfortable and relatively pleasant.

> “There is no safe amount of air pollution, which means the less air pollution produced, the safer it will be for construction workers.”

Economic sustainability

In order to be sustainable a construction business must operate efficiently and use resources responsibly so that it can deliver an operational profit.

One area where contractors can cut costs is through the use of electric plant hire tools. Electric motors have fewer moving parts, they require less maintenance and may even have a longer lifetime than combustion engines. This will save on both the direct cost of fuel and on engine maintenance costs, all of which will add up over the lifetime of a tool. It will help remove fossil-fuel from construction site.

Battery power will mean that there will be no more need for expensive diesel generators and air compressors and no more noisy and polluting two-stoke and four-stroke petrol engines powering plant hire tools. Instead clean electricity from the grid can be used to charge the batteries to power the tools. And, by charging batteries overnight, business can take advantage of cheaper and, generally, greener electricity.

Battery powered plant hire tools also have the benefit that they can be used on remote sites, where electricity is not available, which can open up new opportunities for work.

In addition, because battery powered equipment is considerably quieter than combustion engine powered equipment, the number of hours of the day where machinery can be used could, potentially, be extended. This could lead to improvements in the efficiency and productivity of construction sites. Electrified equipment also opens up the opportunities for extended use inside buildings, on difficult inner-city sites and in other noise sensitive areas.

CHAPTER 4

The growing phenomenon of the Zero Emission Construction site

Introduction

To tackle the climate emergency cities around the world are using a combination of public procurement and increasingly onerous environmental standards to force the construction industry to decarbonise. Buildings are currently responsible for 39% of global energy related carbon emissions,11% of which is from materials and construction.

Oslo

In the Norwegian city of Oslo, construction is responsible for 7% of the city's total emissions, even without accounting for emissions from the transport of people and materials to and from construction sites. Construction also contributes to local air and noise pollution.

2016

In 2016, Oslo set a climate strategy for a 95% reduction in emissions by 2030.

2017

In 2017 Oslo published a new procurement strategy, requiring all municipal construction projects to use, where possible, electric technology for all vehicles and construction machinery.

2019

In 2019, Oslo's climate budget set out measures to support the move from fossil fuel-powered to electrified construction equipment using public procurement to help develop the market.

In September 2019 the first zero-emission construction site began operation using only electrified construction equipment.

2025

By 2025, all municipal construction sites in the city will be zero emission.

2030

By 2030, all construction in the city, including private developments, will be zero emission.

What is a Zero Emission Construction Site?

A construction site in which construction activities are carried out exclusively with zero emission construction equipment and machinery, and all transport of goods and people to and from the site using zero emission vehicles.

Where electricity is used to power tools and equipment, the providence of the energy carrier is not included in the definition, although this might change in the future.

Amsterdam

Amsterdam is another city engaged in transforming construction through procurement. In contrast to Oslo, it has taken a more collaborative approach using a framework-type agreement. This sets contractors a minimum initial carbon reduction target which increases over the length of the eight-year contract.

Amsterdam has joined forces with Copenhagen, Oslo, and other cities through the Big Buyers initiative and Clean Construction to help create zero emission construction sites through joint Green Public Procurement initiatives.

Copenhagen

As part of its strategy to be climate neutral by 2025 the city is committed to building all new buildings and to renovate existing buildings in line with low energy principles. The city aims to be fossil fuel free by 2023. Copenhagen is also leading member of the Big Buyer's initiative and is set to implement procurement strategies focused on the construction sector.

Helsinki

The city is set to implement a similar procurement strategy to Oslo for the construction of municipal projects. In May 2020, the cities of Espoo, Vantaa and Turku adopted similar policies to those of Helsinki. The government has supported the cities' action by adopting the Green Deal agreement aiming at 100% fossil–free construction sites from 2025.

UK

In the UK, the need to tackle rising air pollution is leading many local authorities to take action by introducing clean air zones and tighter air pollution standards. The cities of Bath and Birmingham already have Clean Air Zones (CAZ), Bristol is expected to introduce one later this year. Cities planning a CAZ include Bradford, Leicester, Manchester, Newcastle, Portsmouth, Oxford and Cambridge.

London has two clean air zones, the first is the Low Emission Zone, which covers the majority of the capital, while the Ultra Low Emissions Zone has stricter rules and covers the same inner area as the congestion zone. The Ultra Low Emissions Zone will be expanded further in October 2021.

Clean air zones can present a significant challenge for the construction industry, particularly if the local authority considers machinery being used on construction sites as a significant contributor to emissions. In such cases, the government says the local authority "should seek to work with local businesses to address the associated emissions, for example by encouraging them to deploy newer, cleaner equipment in the zone".

A local authority may also consider using the land use planning system to address emissions from construction machinery in Clean Air Zones through Supplementary Planning Guidance and planning conditions relating to the construction phase of the development.

In the future, the need to tackle air pollution and reduce carbon emissions is set to see many more Local Authorities and proactive developers demanding zero emission construction. Switching to battery powered plant hire tools will help construction managers comply with current legislation and future proof themselves ahead of any further tightening of developers' and Local Authority's requirements or regulations.

Global Clean Construction

C40 is a network of the world's megacities committed to addressing climate change. It supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change. The Clean Construction Forum is an initiative from the C40 to support cities in the transition to resource-efficient, zero emission construction. It has a focus on reducing emissions from construction materials and machinery.

Participating cities are actively sharing policies, strategies and ideas. Current focus areas include:

- Engagement with the private sector to ensure it is prepared for zero emission construction policies.
- Using the collective purchasing power and political clout to develop a market for low emission construction equipment.
- Articulating the collateral benefits – reduced air and noise pollution, job creation, increased health and well-being of clean construction policies.

Budapest, Los Angeles, Mexico City and Oslo have joined forces to set collective targets through the C40 Clean Construction Declaration and have committed to municipal actions. Their declaration includes the commitment to procure and, where possible, use only zero emission construction machinery from 2025 and require zero emission construction sites city-wide by 2030

Another global initiative to reduce emissions is the UN-backed Race to Zero campaign. This initiative is aimed at non-state companies and cities to take immediate action to halve global emissions by 2030 to deliver a healthier, fairer zero carbon world.

UK members of the campaign include many of the country's major developers including: Balfour Beatty, Barratt Developments, Costain Group, Countryside Properties, Berkeley Group, British Land, Capital & Counties Properties, Derwent London, Great Portland Estates, Hammerson, Helical, Laing O'Rourke, Landsec, Mace, Persimmon, Redrow Homes, Taylor Wimpey.

UK cities that are members include: Bournemouth, Bristol, Greater Manchester, Leicester, Plymouth and Taunton

Energy supply to construction sites

As soon as planning permission has been obtained for a new development, many developers are keen to commence construction work at the earliest opportunity which means contractors often have take control of the area to be redeveloped relatively quickly. In many instances the existing electrical supply to the site is insufficient to meet a site's power demand and it can often take a significant amount of time for the district network operator to install a suitable substation. This often means that the requirement for onsite power is met through the use of diesel generators, usually hired, until a new electricity sub-station can be built or the district network operator can install an enhanced electrical supply to the site.

Another problem with the use of generators for site power supply is that they are often used inefficiently. The same generator is often used to meet the daytime demand, when the site is running at full capacity, which is then run overnight when demand is much lower. Generators run less efficiently at loads of less then 25%, which burns more fuel unnecessarily.

One solution to providing electrical power efficiently to a site is the use of hybrid power generators. These incorporate a battery in addition to a diesel engine. An intelligent control system will switch the supply to battery when loads are low. The use of hybrid power generators can reduce fuel consumption, carbon emissions and even maintenance costs as a result of the engine running less.

An alternative solution to decarbonising site generation is the use of hydrogen. This is being trialled by Mace Construction in a hydrogen fuel-cell powered-generator as part of the contractor's commitment to transition away from highly polluting diesel generators. Mace is looking to achieve a 10% year-on-year reduction in carbon emissions from its operations and to remove diesel generators from its sites by 2026. The downside of this solution is that it relies on the hydrogen fuel being produced without emissions, which is a challenge with current technology

Of course, where it is possible to use power direct from the national grid, rather than from on-site diesel generators, this will allow the use of corded electric tools and plant, which can reduce on-site emissions and noise levels. However, the length of time it can take for the distribution network operator to install a suitable sub station can be considerable, which can be a significant barrier to the electrification of construction sites.

The advantage of using battery power for plant hire tools is that it enables the batteries to be charged remotely, helping to remove demand from the site's electrical supply.

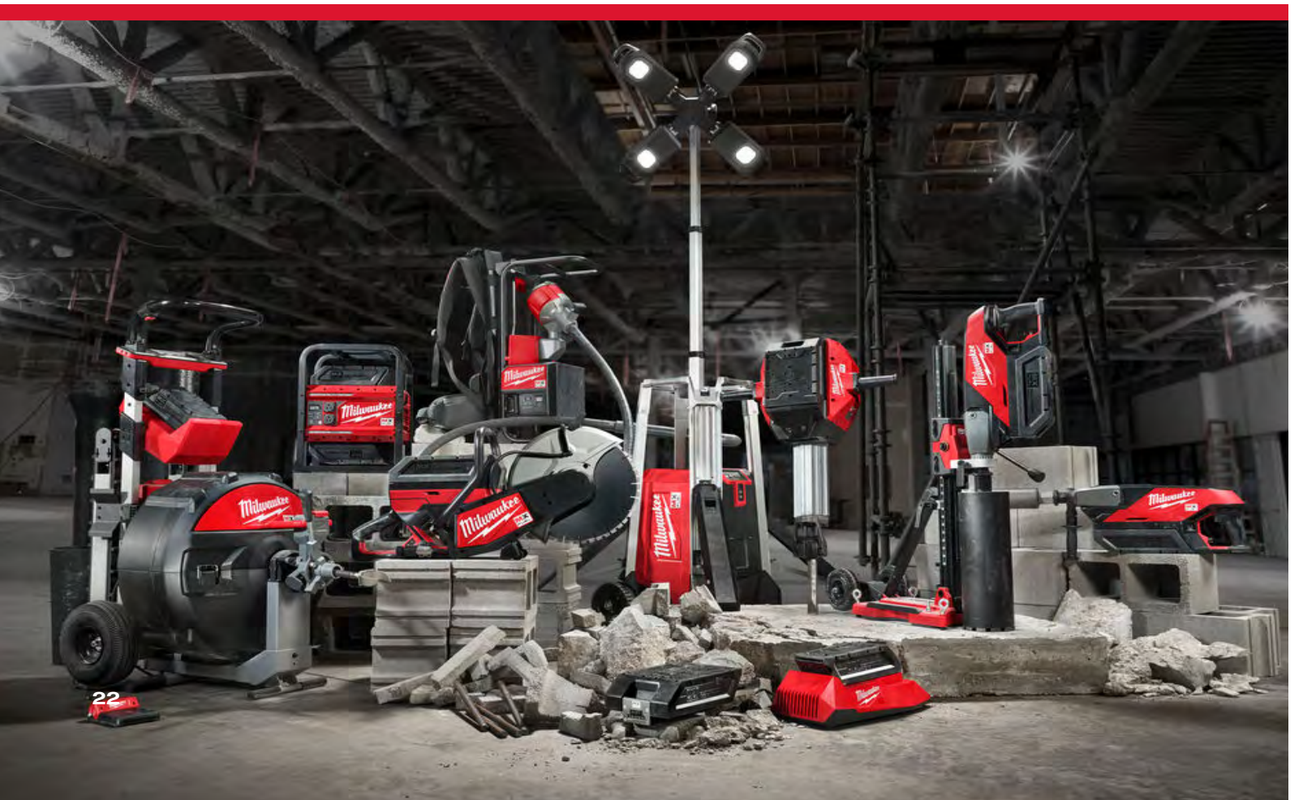
CHAPTER 5

Zero emission plant hire tools

Introduction

Quiet, clean and green are not words typically associated with plant hire tools for construction projects, until now....

Milwaukee's MX FUEL™ range of market-leading battery powered plant hire tools are at the forefront of the zero emission revolution for the light plant hire equipment market. The tools produce zero emissions on the construction site; incorporate virtually silent electric motors that deliver power instantaneously and with minimal vibration and have minimal running costs. In addition, the tools' outstanding ergonomic design ensures ease of handling to maximise productivity, while freedom from electrical leads which improves safety.



What are the benefits of Milwaukee's zero emission plant tools?

Traditionally, plant hire tools have been powered either by a combustion engine or from a temporary site electrical supply, often provided by polluting diesel-powered generators via a power lead. A major downside of combustion engines is that they emit gasses such as carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen oxides and, in the case of diesel engines, particulate matter. Some of these gasses contribute to climate change, others are harmful to operatives and the general environment.

Milwaukee's MX FUEL™ battery-powered plant hire tools have zero emissions. That means that there are virtually no limitations on where work can be carried out; the tools allow operatives to work safely indoors, in trenches, in tunnels or even in mines. The MX FUEL™ battery pack also enables tools to be used on remote sites where electricity is not available, which can open up new opportunities for work.

The potential emission savings to be had from using Milwaukee's MX FUEL™ range of tools are significant, for example:

- The Cut-Off Saw can save over 332.28 kg in CO_2 from being released into the atmosphere in one year compared to direct petrol-driven competitors;
- The MX FUEL™ Breaker can save more than 2433.60 kg of CO_2, over a year; and
- The MX FUEL™ Tower Light will save over 4061.57 kg of CO_2 over a year.
- By comparison, a van travelling 10,000 km will emit roughly 907kg of CO_2

Tools powered by combustion engines are also expensive to maintain because engines are assembled from a large number of parts, increasing the likelihood that any one of these might fail or require maintenance. Furthermore, electric motors are more efficient at transferring energy into motive power. Milwaukee's MX FUEL™ range uses a POWERSTATE™ brushless electric motor, which requires minimal maintenance because it has very few wearing parts when compared to a petrol engine, REDLINK PLUS™ electronics and a REDLITHIUM™ battery pack to deliver a superior performance with outstanding run-time.
The running costs of battery-powered tools are also significantly cheaper than for the petrol-powered equivalent, much in the same way an electric vehicle is cheaper to run than a combustion-engine car.
The shift to battery power will reduce a contractor's dependence on oil, helping insulate them from the volatility of oil prices while improving energy security.

A major safety and environmental concern with combustion-engine tools, is that the engines are often left idling when not in use to save having to re-start the engine again. Where this is the case, engine vibration can cause the tool to move, which could cause it to collide with something or fall off a platform with potentially fatal consequences.

The MX FUEL™ integrated 'push to activate' button enables the tool to be started in seconds; this not only saves time but also ensures users never need to leave a tool idling. And, instead of time spent refuelling, it is simple to insert a battery, press the start button and pull the trigger. Battery power also means there is no need for petrol on site, further improving safety

In use, combustion engines are noisy. Noise can also interfere with verbal communication, which can lead to accidents and affect operations on the site and can disturb the site's neighbours. Compared to direct petrol-driven competitors, tools powered by the MX FUEL™ Equipment System produce less noise, which means that the number of hours of the day where machinery can potentially be used could be extended.

Even on sites that are powered using grid electricity, the advantage of using Milwaukee's MX FUEL™ system is that it eliminates the potential trip hazard of power cables and hoses; it eliminates the time taken to re-plug a cable or relocate a transformer; improves safety and enhances mobility to which helps increase productivity. The revolution is underway....

CHAPTER 6

Future drivers for zero emission plant tools

Introduction

On 20 April 2021 the UK government set in law a target to reduce carbon emissions by 78% by 2035, compared to 1990 levels. The target brings the UK more than three quarters of the way to its target of net zero by 2050. The introduction of the 2035 target shows that the UK government is starting to get serious about the need to take action to help protect the health of our planet.

Whether this national emissions reduction commitment will impact the construction industry directly is yet to be seen. It could, for example, see the introduction of national initiatives similar to those set by cities such as Oslo, Stockholm and Copenhagen in demanding cuts in emissions from construction sites.

The government is also set to target air quality with the publication of the Environmental Bill. The Bill is set to be introduced at roughly the same time as the government's increasing tax on diesel fuel used on construction sites. Meanwhile, at a local level, many city councils are also looking to drive down emissions and improve air quality with many aiming for their cities to be zero emission zones within the decade.

Developers and contractors too are responding to demands for actions to address climate change by targeting net zero emissions.

Future increases on fuel tax

To incentivise contractors to invest in cleaner alternatives to fossil fuel, the UK government announced in 2020 that it would remove the entitlement for contractors to use red diesel from April 2022.

Red diesel is licensed for use in generators and vehicles that do not use roads such as bulldozers and cranes. It has a fuel duty of 11p per litre compared with 58p for regular diesel.

The government says that the tax changes will ensure that most users of red diesel use fuel taxed at the standard rate for diesel from April 2022, like motorists, which "more fairly reflects the harmful impact of the emissions they produce".

Red diesel accounts for around 15% of all the diesel used in the UK and is responsible for the production of nearly 14 million tonnes of carbon dioxide a year. Red diesel used in the construction and infrastructure building sectors was also estimated to have caused 7% of nitrogen oxide emissions and 8% of PM10 emissions (a type of particulate matter) in London in 2018.

The move will be a challenge to the construction industry. Most construction sites do not have readily available grid electricity so provision of electricity is often through a proliferation of small portable diesel generators. Small generators have lower efficiency and lower emission controls than larger generators; they are dirty, noisy, and their emissions are both harmful to the environment and operators' health.

MILWAUKEE®MX FUEL™ battery-powered plant hire tools have zero emissions. That means that there are virtually no limitations on where work can be carried out; the tools allow operatives to work safely indoors, in trenches, in tunnels or even in mines. The MX FUEL™ REDLITHIUM™ battery pack means that sites do not require generators. Battery power also enables tools to be used on remote sites where electricity is not available, which can open up new opportunities for work.

Cities leading the way

Cities have become the leaders in the global movement towards cutting emissions. Cities can influence around 70% of the worlds emissions. As such, they play a key role in the transition to decarbonisation and the creation of better environments in which to live by protecting citizens from noise and air pollution.

While the UK is targeting net zero by 2050, London's mayor, Sadiq Khan has announced that the capital will target net-zero by 2030. Similarly, Oxford, Bristol City Council and Bournemouth, Christchurch and Poole Councils have all committed to delivering a net zero city by 2030, as have Glasgow, Newcastle, Leeds and Edinburgh. Not to be outdone, Nottingham has announced plans to become a carbon neutral city by 2028

In Norway, Oslo has announced a target of a 95% reduction in emissions by 2030. In line with this target, as of 2025 all of the city's publicly construction sites will operate zero emission machinery and zero emission transport of materials and workers to the site. By 2030, all construction in the city, including non-municipal projects, will have to use electric or other zero emission technology.

Developer and contractor initiatives

Developer Lendlease has announced a target to reach net zero emissions by 2040 for its European footprint. Included in its Roadmap to Absolute Zero Carbon is a commitment to eliminate diesel use on construction sites and to procure 100% renewable electricity.

British Land too has published its Pathway to Net Zero document, which details the steps it will take to achieve a net zero carbon portfolio by 2030, while Great Portland Estates has published The Time is Now, a document that sets out how it intends to decarbonise its business to become net zero by 2030.

Similarly, contractor Mace has committed to achieve a 10% year on year reduction in carbon emissions from its operations and to remove diesel generators from its sites by 2026. This will include the use of hydrogen-fuel powered generators

Willmott Dixon is also focusing on eliminating fossil fuels from its construction sites. The contractor says that wherever it can, it uses plant and equipment powered by electricity rather than diesel, since it produces fewer emissions. Similarly, when hiring plant the contractor has a preference for kit which is less than 18 months old, because the newer the equipment, the more energy efficient it is.

The future is electric

In the future, as clean air zones continue to become more widespread across Europe and developers and contractors respond to the climate agenda, the transition towards clean electric equipment and away from fossil-fuel powered plant is set to accelerate.

The MILWAUKEE®Jobsite Solutions (JSS) team is a pioneering and dedicated power tool specialist and problem solving team to the construction and industrial industries. They work on the front line of power tool innovation everyday across all trade sectors, helping the industry increase productivity, save costs, and remove dangerous hazards from the jobsite.

Since the introduction of the MX FUEL™ range the JSS team have been actively working with large and medium sized companies to apply the benefits of the battery powered equipment system on working sites. With a growing team and persistent focus on putting world's first technology into the hands of operators, the adoption of the MX FUEL™ range has grown and the real cost saving and safety benefits are being realised across the UK.

Dan Stringer – JSS National Manager for MX FUEL™ explains: "Our approach is to fully understand contractors needs and challenges and support in overcoming them. This is largely done by looking at real life applications on site and offering solutions that are safer and more productive. MILWAUKEE®now have one of the largest ranges of cordless battery power tools in the industry operating across 3 platforms: M12™ (12v), M18™ (18v) and most recently MX FUEL™.

Furthermore, these products are complemented by a range of hand tools, accessories and PPE enabling our team to offer a full solution that tackles contractors' challenges head on.

Over recent years cordless jobsites, zero emissions and health and safety improvements have been key concerns across the construction industry. Everyday contractors and clients ask us if we have anything to help in these areas, the good news is we do! We have products that have never been offered before on a battery platform and which can eradicate the need for carrying fuel or trailing cables, such as the MX FUEL™ MXF DH2528H 25kg class Demolition Hammer.

Our industry demands that we, as manufactures, innovate in order to tackle changing legislation and every day jobsite challenges. We are proud to be at the forefront of new technology and our innovation doesn't end here either, we have many more exciting new products in our pipeline coming to jobsites across the country very soon!"

Through the work of the Job Site Solutions team the MX FUEL™ range is now available to an ever expanding number of sites across the country. Speedy Hire became the first provider to offer the MX FUEL™ TL Tower Light as part of their fleet to help contractors reduce on-site emissions and make significant savings in fuel costs, following successful trials with national customers including Balfour Beatty.

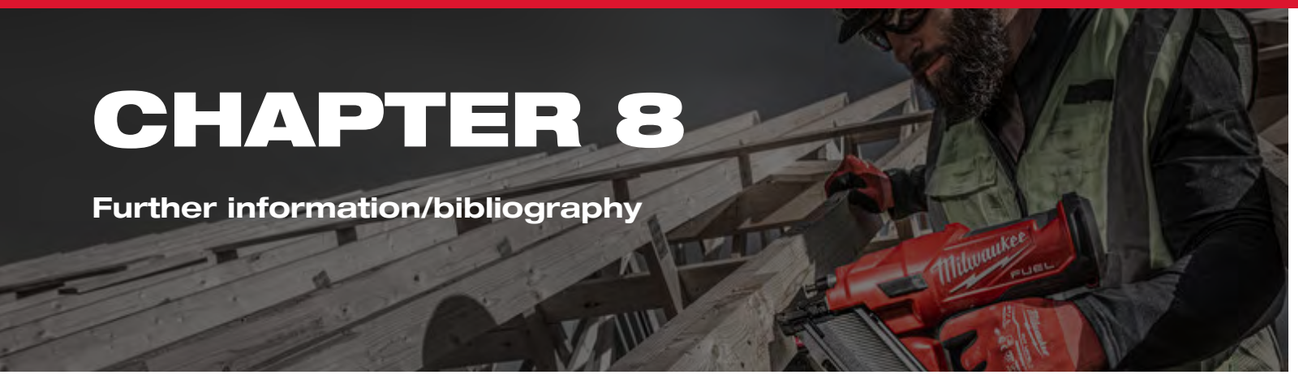
Andy Connor, supply chain director at Speedy, said: "The new MX FUEL™ range really is a game changer for the industry, introducing high-performance cordless equipment that will help our contractors make significant strides towards delivering zero emission sites. As a key intermediary in the sector, we recognise the significant role we play in creating a greener supply chain, and this investment forms part of our ambitious sustainability strategy to ensure ECO products account for 70% of our itemised equipment fleet by 2026."

> "The new MX FUEL™ range really is a game changer for the industry, introducing high-performance cordless equipment that will help our contractors make significant strides towards delivering zero emission sites."
>
> **Andy Connor, Supply Chain Director**

On site, following successful trials offered by JSS there has also been strong feedback on MX FUEL™. When Drainline Southern were looking at purchasing a new hydraulic power pack for a new civils gang they decided that there may be a possibility of replacing the traditional petrol hydraulic pack with a battery powered electric alternative. The operations team then set about finding a suitable alternative product that would be capable of carrying out the same tasks. After extensive research, the MILWAUKEE®MX FUEL™ MXF DH2528H 25kg class Demolition Hammer was identified as just that. A sample was purchased and put into action.

Following extensive testing, Drainline concluded: "The Milwaukee MX FUEL™ Hex Demolition Hammer has similar vibration levels to the equivalent petrol power pack but has no trailing hydraulic cables, no awkward hydraulic couplings to connect, no need to refuel, this eliminates the need to carry fuel and refuel on site and leads to reduced long term costs and zero emissions leading to no harmful pollutants entering the environment.

An additional 3 units have been purchased as Drainline aims to further reduce its carbon emissions and be an environmentally friendly supplier.



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