

## 5. Practical Guides

### 5.1. Customer Requirements

European rental market customers are a complex mixture of companies and individuals. At the larger end of the market, there are large construction contractors, construction developers or infrastructure owner-operators. At the smaller end of the market, there are thousands of small construction and civil engineering firms as well as individuals carrying out “Do-It-Yourself” construction work.

The professional construction industry is subject to significant economic and political forces, some of which are highly relevant to sustainability considerations. For example, the EU’s Circular Economy Action Plan<sup>1</sup>, states:

- The Commission will launch a new comprehensive Strategy for a Sustainable Built Environment
- The Commission may set higher mandatory material recovery rates from construction wastes
- Initiatives may be introduced to reduce soil sealing, rehabilitate abandoned or contaminated brownfields and increase the safe, sustainable and circular use of excavated soils;
- Construction clients will also be mindful of the wider ‘Renovation wave’ proposed under the Green New Deal, which will prioritise the renovation and improvement of energy efficiency in existing buildings.

Similarly, as discussed in the Regulation section, many larger customers will be subject to the full weight of CSRD and CSDDD, which is likely them passing on indirect regulatory requirements to suppliers.

Suppliers of large companies should therefore expect:

- To be subjected to a rigorous level of environmental and social due diligence.
- To provide transparent data, compliant with ESRS (which goes beyond GRI (Global Reporting Initiative) standards, although GRI is a good start) across a number of sustainability topics. This could include:
  - Full Scope 1, 2 and 3 Greenhouse Gas (GHG) emissions disclosure
  - Product or service level carbon emissions
  - Other data on waste, circularity, pollution, social and biodiversity impacts
- To be able to showcase examples of good practice (including EU Taxonomy alignment) as well as risk and impact management in tender responses.

Small companies may still service larger customers, and should consider the following as ‘minimum sustainability requirements’:

- Ensure people risks are well managed. Even small companies should be able to answer all Health & Safety (H&S) questions and provide certificates when requested. ISO 45000 in the Nordics is a default, but alternative proof could be SafeHire<sup>2</sup> or VCA<sup>3</sup> which are available across Europe. The ERA is also preparing a digital toolbox for rental companies covering practical aspects of occupational health and safety. This is likely to be published by the end of 2024.
- Staff training undertaken should be recorded and evidenced.

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<sup>1</sup> [https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF)

<sup>2</sup> [www.hae.org.uk/safehire/](http://www.hae.org.uk/safehire/)

<sup>3</sup> [www.vcadirect.com](http://www.vcadirect.com)

- Companies should have at least a policy or code of conduct in place for equality, diversity and inclusion (EDI).
- Ideally small companies supplying into larger companies will have full ISO 14001 (Environmental Management) coverage across sites, but at the very least, have an environmental policy in place.
- Small companies should at minimum have their own energy measurements, Scope 1 and 2 measurements and a reduction plan to impact Scope 1 and 2, and may increasingly need to consider Scope 3 (note that ERA will publish sectoral guidance in 2024 for rental companies covering the calculation and reporting of corporate carbon including scope 3).
- Privacy and GDPR compliance, as well as IT security should be comprehensive and rigorous.

**Carbon accounting** - An important consideration from the customer point of view when deciding to buy or rent is their carbon accounting. A (larger) contractor will need to report their emissions on an annual basis and they will only include in their company carbon footprint a small amount of carbon for when they rent (based on the rental charges and any fuel usage). Comparatively, if they buy a piece of equipment, they will have to account for the entire embodied carbon footprint of the machine in the first year of ownership.

## 5.2. Asset Purchasing

For rental companies, making decisions about purchasing new assets is one of the most important aspects of their business. A good decision about asset purchasing can ensure the company has a reliable and affordable asset that delivers what customers want, while a poor decision may mean the company is left with a poorly performing asset that is also difficult to dispose of.

Rental companies today have additional challenges when considering sustainability. Companies may wonder which sustainability parameters should be considered when evaluating different asset options, or the extent to which it is worth paying more for assets which deliver sustainability advantages. Tools such as the ERA Equipment CO2 and TCO Calculators, available at [www.equipmentcalculator.org](http://www.equipmentcalculator.org), are independent and free-to-use for making economic and environmental choices when using construction equipment.

Key sustainability considerations in asset purchasing:

- **Asset powering and in-use emissions:** The decision of whether to purchase a diesel, electric, hybrid or other type of asset is one of the key elements in asset purchasing today. See the section of this guide titled 'Vehicles, Equipment and Site Power Options' for more detail.
- **Manufacturer and supplier transparency:** Purchasing from a manufacturer or dealer who is responsive and knowledgeable about their products, especially in terms of their sustainability performance, is vital for rental companies today. The increasing trends of sustainability disclosure (e.g. CSRD) and supply-chain due diligence (e.g. CSDDD) mean that rental companies may need to interact with and obtain extensive data from equipment manufacturers and suppliers. Having a good relationship with a professional and appropriately resourced supplier will make due diligence and disclosure processes significantly easier.
- **Lifespan, lifecycle and circularity:** While many rental assets are traditionally assumed to last for 10,000 hours operation or seven years before reaching the end of their economically useful life,

there are many other considerations which can play into this. The existence and strength of a second-hand market is clearly important to rental companies purchasing new equipment, but there are increasing options from manufacturers offering buy-back or re-lifing options<sup>4</sup>, as well as new obligations being placed on manufacturers by legislation to take responsibility for their products back at the end of life (for example, see the new extended producer responsibility rules applied to batteries in the EU's Batteries Regulation). Purchasing assets that have a clear and sustainable end-of-life or re-life plan is therefore likely to become simpler for rental companies. However, there are challenges where the asset incorporates relatively novel technology and so data on residual values and economic lifespan is therefore limited (for example, as new types of battery are brought onto the market).

- **Standardisation:** Rental companies should consider whether equipment is sufficiently standardised and flexible, for example in having a universal charger (standardized plugs and sockets) for large equipment and machinery, or having swappable batteries which could help in improving circularity and lifespan of equipment.
- **Embodied emissions and supply chain impact:** As well as the emissions from an asset while it is operated on a client site, rental companies should also consider the embodied emissions and wider supply chain impact of the equipment. These 'upstream' value chain impacts are specifically required to be reported under CSRD and conducting due diligence into the manufacturer supply chain is required under CSDDD (see Regulation section in this Guide for more details on this legislation). Typically, certain materials and activities in the supply chain will have the greatest sustainability impact – for example, producing certain metals such as aluminium from mined ores is highly energy intensive, leading to a higher Scope 3 footprint in Category 1: Purchased Goods and Services.
- **Cost:** The cost of new assets is clearly a critical consideration for rental companies, as the depreciation and initial cash flow must be covered by rental income.

What does good practice look like for rental companies in sustainable asset purchasing?

- Be aware of any legislation that applies to your company or your clients, or which is likely to apply in the future.
- Build close relationships with key suppliers and equipment OEMs to ensure you understand the benefits and drawbacks of their products.
- Incorporate sustainability into decision-making by considering the six points outlined above.

### **Case study: Remanufacturing and re-lifing machinery**

Caterpillar Inc is a USA-based company and one of the largest manufacturers of construction equipment in the world with revenues of over \$60Bn. The company has targeted aggressive growth in remanufacturing of equipment and components, achieving a 19% increase in revenues for remanufactured products between 2018-2022.

Remanufacturing refers to the process of restoring product at the end of their lives back to the Original Equipment Manufacturer (OEM) standards or specifications. It therefore requires high levels of skill and

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<sup>4</sup> For example, see [www.hitachicm.com/eu/en/buy-back-hitachi-wheel-loader/](http://www.hitachicm.com/eu/en/buy-back-hitachi-wheel-loader/) and in Low and Pasadilla (2016)

precision in labour and tooling, as well as access to the OEM's intellectual property, and can often therefore be distinguished from recycling (where materials are extracted for a range of other, generally lower-value, uses) and refurbishment/reuse (where a product is typically placed into a less-onerous application after minor repair)<sup>5</sup>. For example, remanufacturing can add value through the specialist cleaning and inspection processes used by OEMs, the use of additive manufacturing technologies and other techniques such as laser welds, metal spraying, re-coatings and the inclusion of upgrades which can make the product 'better than new'<sup>6</sup>, and at least means they are sold with the same warranty as new products.

Caterpillar state that their 'Cat Reman' programme has achieved 140 million pounds (c63,000 tonnes) of material taken back for remanufacturing in 2022, with the process producing 65-87% less GHG process emissions and requiring 80-90% less material by mass compared to manufacturing of new parts<sup>7</sup>. The company now has 17 remanufacturing facilities worldwide, employing over 4,000 staff.

### 5.3. Telematics

Telematics is a blanket term for technologies that can track physical assets and collect and transmit data on them remotely. Telematics is therefore part of the wider drive for digitalisation in many industries, particularly in transport and construction. It has close connections to asset management as well as Building Information Modelling (BIM<sup>8</sup>). A wide range of telematic systems exist, both integrated by OEMs (Original Equipment Manufacturers) and aftermarket, but many can allow equipment rental companies and operators to:

- Track the physical location of an asset
- Obtain information about the asset's attributes e.g. state of battery charge, fuel consumption
- Obtain information about how the asset is being operated e.g. speed, changes in direction etc

Implementation of telematics can offer the following sustainability benefits:

- Insight into driver and operator usage, providing opportunities to offer training to improve safe and fuel-efficient usage and aiding both environmental and social goals
- Availability of more precise data from equipment can improve maintenance regime and energy efficiency
- Provision of data to end client for their own utilisation and sustainability reporting
- Better information can significantly reduce the likelihood of environmental incidents with some assets e.g. site accommodation and toilets which automatically flag when they need emptying, thereby removing the risk of overflow
- Reminders to charge electric equipment at appropriate times can eliminate flat battery instances and increase utilisation of a more sustainable asset.

There are also, of course, numerous benefits from telematics in terms of customer satisfaction and fleet management which are not directly relevant to sustainability.

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<sup>5</sup> Low and Pasadilla, 2016.

<sup>6</sup> [www.ellenmacarthurfoundation.org/circular-examples/design-and-business-model-considerations-for-heavy-machinery-remanufacturing](http://www.ellenmacarthurfoundation.org/circular-examples/design-and-business-model-considerations-for-heavy-machinery-remanufacturing)

<sup>7</sup> <https://s7d2.scene7.com/is/content/Caterpillar/CM20230428-315ef-024e2>

<sup>8</sup> For more information, please see the ERA's guide to BIM - <https://erarental.org/publications/a-beginners-guide-to-building-information-modelling-bim/>

The ERA report<sup>9</sup> ‘The Impact of Digitalisation in the Rental Industry’, available at <https://erarental.org/publications/the-impact-of-digitalisation-in-the-equipment-rental-industry/>, contains additional information for rental operators interested in the benefits of telematics and how to deploy systems into fleets. The ERA has also published recommendations from the rental companies to OEMs on the data points that the rental sector needs to have in telematics<sup>10</sup>.

### **Case study: Telematics and digitisation for earthmoving machinery**

The HS2 project is a large infrastructure project in the UK to create additional high-speed rail capacity. The project recently announced<sup>11</sup> that the use of telematics on earthmoving equipment has successfully saved £25m of costs as well as substantial amounts of carbon emissions, due to greater efficiency.

Advanced telematics including electronic weight sensors have been mounted on the 700 machines in use by the EKFB Joint Venture working on HS2’s central section. These allow a central team at the central Brackley site base to view the work status of excavators and identify instances where machines are idling because they are waiting for a dump truck to haul away arisings. The team can then redeploy equipment into more efficient work, as well as identify pinch points on sites where logistics need to be improved to allow better flow of mobile equipment.

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<sup>9</sup> <https://digitalisation.erarental.org/>

<sup>10</sup> <https://erarental.org/publications/data-points-telematics-era/>

<sup>11</sup> <https://www.constructionnews.co.uk/civils/digger-data-cuts-costs-and-carbon-on-hs2-earthworks-14-11-2023/>

## 5.4. Environmental Controls

Environmental controls are procedures covering aspects such as emissions of pollutants or wastes to air, water and land. International treaties, national regulations and local bye-laws can all affect how companies control these emissions, and whether they have to be approved or permitted.

Aspects likely to be important to rental companies are:

- Emissions to air of engines and other equipment using fossil fuels. This equipment can produce Nitrous Oxides (NOx) and particulate matter, as well as the well-known greenhouse gas CO<sub>2</sub>. Particulate matter is generally classified into either PM<sub>2.5</sub> or PM<sub>10</sub>, depending on the size of the particles produced, and many urban areas today have limits on the type of engines that can be used because of the PM<sub>2.5</sub> or PM<sub>10</sub> they produce.
- Emissions to water and land. These are most likely to be relevant to rental companies in the case of accidents or incidents where substances are inadvertently or negligently released, or potentially where staff or individuals intentionally or maliciously allow harmful substances to enter the environment. For example, stored quantities of fuels might be accidentally lost from a bowser if it is damaged by a collision.
- Generation and management of wastes, especially when wastes have the potential to be hazardous to the environment or people. For example, used engine, hydraulic and lubricating oils, antifreeze, paints and waste fuels can all cause serious harm if incorrectly disposed of.

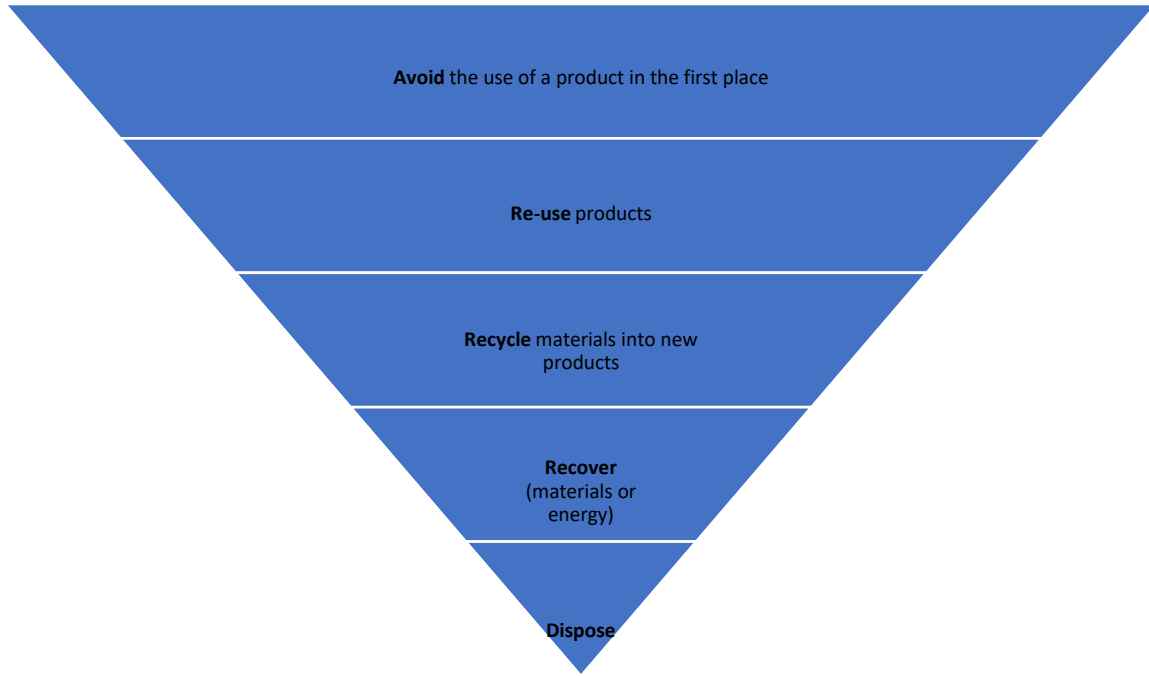
What should rental companies be aware of?

- Ensure they are aware of relevant local regulations so as to be able to advise clients on the safe, sustainable and legal use of hired equipment and equipment e.g. the operation of local ULEZ (Ultra Low Emissions Zone).
- Ensure they are aware of the relevant rules covering emissions from vehicles (Euro 6/7 especially) and Non-Road Mobile Machinery (Stage V). Although it is the manufacturer's responsibility to design and build compliant engines, rental companies can show their commitment by aiming for the highest standards of sustainability in equipment specification.
- Have a clear list of any hazardous or environmentally-damaging chemical or materials being stored under their control, and make the control and management of those substances part of their regular risk management and incident planning.
- Ensure equipment that is rented out meets the latest standards for environmental protection (e.g. double-skinned or bunded bowsers, use of drip trays, emissions filters etc).
- Follow the waste hierarchy, which means making business decisions that minimise the generation of waste and maximise the valuable use of materials, rather than disposing of items or recycling them to lower-value uses.

### **Example: The Hierarchy of Waste**

The hierarchy of waste is a conceptual model of different actions that can be taken with waste products or materials, ranked from 'most' to 'least' preferable. In general, actions are preferable if they keep products or materials in a higher value state (i.e. the loss of energy, quality or organisation is minimised). For example, a computer could be crushed and made into a doorstop, but a higher-value use would be to salvage and reuse any working components and high value materials.

Most preferable



Least preferable

## 5.5. Vehicles, Equipment and Site Power Options

### Energy usage in the rental sector

Many rental providers have significant fleets of heavy and light commercial vehicles, in order to deliver, maintain and collect the equipment they provide to clients. Historically these fleets have primarily been powered by internal combustion engines (ICEs), but the environmental impacts of burning petrol and diesel are now well understood. As a result, different energy sources and stores are being developed to offer ultra-low emission vehicles (ULEVs) and zero emission vehicles (ZEVs).

Two technologies currently in use and undergoing further development are hydrogen and biofuels, and this section of the guide provides readers a short overview of these technologies, as well as their advantages and disadvantages. It also covers the topic of electrification and the advantages and disadvantages of batteries as energy stores for vehicles, equipment and wider site power, which are highly relevant to rental companies both for their own operational fleets, but also the equipment they can offer to customers.

### Biofuels

Biofuels are broadly any fuel produced from contemporary biological material rather than from fossil fuels. They cover a wide range of products, some of the most common of which are:

- HVO – Hydrotreated Vegetable Oil
- Bioethanol

Biofuels are typically classified into one of four ‘generations’, depending on the original source of their material:

- 1<sup>st</sup> generation biofuels are produced from food crops such as maize, soybeans and sugarcane;
- 2<sup>nd</sup> generation biofuels are produced from wastes and residues such as used cooking oil, wood chip or waste straw;
- 3<sup>rd</sup> generation biofuels are produced from algae and cyanobacteria, and therefore cause minimal Land Use Change (LUC).

Biofuels are already routinely blended with fossil fuels for road vehicles in Europe by either 5% or 10% by volume<sup>12</sup>.

Biofuels are often regarded as more sustainable as fossil fuels, and the reasoning behind this is that, if the entire fuel lifecycle is considered, the carbon dioxide produced by combusting biofuels is re-captured by the biological material that is being re-grown. In this way, it can be claimed that biofuels are carbon neutral.

Biofuels can therefore offer a simple way to reduce emissions for rental companies. However, there are a number of disadvantages which must be considered:

- The assumption that emissions are sequestered by the growing crop is subject to challenge, and must be rigorously backed up with evidence.

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<sup>12</sup> Pacheco and Silva, 2019



- There can be side effects from biofuel production, such as land use change or loss of land for food production, which must be considered when making a sustainability assessment in the round. For example, conversion of peatland to oilseed production is likely to represent a significant loss of soil carbon which means the fuel produced is not carbon neutral.
- Combustion of biofuels still produces greenhouse gases in the same way that fossil fuels do. Some of these are not sequestered, and are still contributing to climate change (for FAME biodiesel, around 8% are not sequestered).
- There is a small price premium still for good quality biofuels over diesel, typically in the order of 10%. Furthermore, biofuels are not as widely available at public refuelling stations as diesel, and will often have to be ordered as a bulk delivery and then stored.

Shall we make a provocative note here that sometimes when OEMs (or rental companies) promote in their marketing certain machines as "zero emission" or similar green claims, they often do not take into consideration the points mentioned above?

The European Commissioner for Energy regulates biofuel in the EU, and set a number of standards for biofuels to meet<sup>13</sup>:

1. Biofuels were mandated to achieve greenhouse gas savings versus fossil fuels, reaching a 60% savings target by 2018. The rising standards are only for new production equipment (the entire life cycle emissions of the fuel are taken into account in these savings which includes cultivation, processing, and transport).
2. Biofuels must not be grown in areas that are currently, or were previously, carbon sinks (e.g. wetlands, forests).
3. Raw materials obtained from areas with high biodiversity, such as forests or grasslands, cannot be used to produce biofuels.

Recent updates to RED II include the phase-out of palm oil and soybean-based biofuels from 2023, and the banning of subsidies for 1<sup>st</sup> generation biofuels in all Member States<sup>14</sup>.

In summary<sup>15</sup>:

First-generation biofuels, on average, have lower GHG emissions than fossil fuels, but the reductions for most feedstocks are insufficient to meet the GHG savings required by the EU Renewable Energy Directive (RED). Furthermore, there are spillover effects in the cultivation of feedstocks which lead to Land Use Change (LUC) and subsequent emissions.

Second-generation biofuels have greater potential to reduce emissions than first-generation fuels, provided there is no Land Use Change.

Third-generation biofuels are not a widely-available option at present as their GHG emissions are higher than those from fossil fuels and they are also very expensive.

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<sup>13</sup> <https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/sustainability-criteria>

<sup>14</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC)

<sup>15</sup> From Jeswani et al, 2020.

### **Case Study: Using HVO Biofuel in a light commercial fleet**

M Group Services is a diversified construction and civil engineering company in the UK, with a stated commitment to achieve a 50% reduction in the Groups emissions by 2030. The company has started using Hydrotreated Vegetable Oil (HVO) to replace fossil-based diesel fuel in its fleet<sup>16</sup>. The HVO being used is a second-generation biofuel produced from a blend of waste and residue derived feedstocks such as vegetable and animal oils. The HVO meets EN15940 specification, meaning it is a certified replacement for diesel.

M Group Services states that the carbon reductions achieved from using HVO are over 80%. As described above, the emissions associated with HVO are treated as 'short cycle carbon' because they are derived from elements that are already part of our current natural ecosystem, rather than releasing carbon locked up in fossil deposits over geological timescales. The use of a second-generation biofuel also addresses concerns that biofuels can displace food crops or lead to deforestation, and the company has worked with Green Biofuels ([www.gbf.ltd](http://www.gbf.ltd)) to source appropriate fuel, whose provenance is certified through the ISSC (International Sustainability & Carbon Certification) scheme.

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<sup>16</sup> <https://mgroupservices.com/news/parting-ways-with-fossil-fuels/>

## Hydrogen

Hydrogen is the simplest and most abundant element in the universe. It has been used as a fuel for many years, but poses significant engineering challenges in its capture, storage and energy extraction.

Hydrogen can be used as a fuel in two principal ways – in combustion engines and in fuel cells.

In a combustion engine, hydrogen gas is burned in air in a similar way to conventional fuels like petrol. Unlike fossil fuels, however, hydrogen gas does not have carbon atoms in its chemical formula, and so combustion does not produce carbon dioxide (CO<sub>2</sub>) or methane (CH<sub>4</sub>), which are two of the most important greenhouse gases. Small amounts of waste gases such as nitrous oxides (NO<sub>x</sub>) are produced.

Efforts have been made to develop hydrogen-combustion engines for construction equipment<sup>17</sup>, although at the time that this report was written we are not aware of any vehicles or mobile equipment of this type actually available for rental companies to purchase.

A more popular method of using hydrogen is in hydrogen fuel cells. These take hydrogen and the oxygen in air and, using a chemical process with a catalyst, output energy and water. Fuel cells have been used in construction equipment and rental applications for a number of years, for example in applications where emissions or noise must be minimised such as working in tunnels or confined spaces. An example is the BOC Hymera hydrogen-fuelled small tool generator, which can provide 175W with 7kWh of power using a hydrogen cylinder<sup>18</sup>.

Hydrogen is often given labels depending on the method used to obtain it. The vast majority<sup>19</sup> of hydrogen today is 'grey' or 'brown' hydrogen, produced by gas reforming or coal gasification which emits significant greenhouse gases. 'Green' hydrogen would be needed in order to ensure that a hydrogen system is sustainable – that is hydrogen produced using renewable and clean processes, typically electrolysis powered by renewable energy. 'Blue' hydrogen is grey hydrogen but where the emissions are captured and stored. Various other colours of hydrogen are also sometimes referred to, including 'turquoise' and 'pink' hydrogen.

Overall, the disadvantages of hydrogen are:

- Low energy density (1 kWh of energy in hydrogen takes up a lot of space, so tanks must be bigger).
- Hydrogen is a very small molecule and hydrogen gas is very explosive. There are therefore significant engineering challenges around ensuring a hydrogen system is leak-free and safe, and resultant cost of these systems is high.
- Inefficiencies in storing and transporting hydrogen.
- Currently there are very limited sources of truly sustainable 'green' hydrogen (less than 1% of hydrogen production globally).
- In most places there are limited places to purchase or fill up vehicles with hydrogen.

The advantages of hydrogen to the rental industry are:

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<sup>17</sup> See, for example, <https://www.jcb.com/en-gb/campaigns/hydrogen>

<sup>18</sup> <https://www.boconline.co.uk/en/gases-and-equipment/hymera-hydrogen-fuel-cell-generator/index.html>

<sup>19</sup> <https://www.woodmac.com/market-insights/topics/hydrogen-guide/#:~:text=How%20is%20hydrogen%20produced%3F,hydrogen%2C%20from%20coal%20via%20gasification.>

- It does not produce significant quantities of greenhouse gases (if produced sustainably).
- In principle, it can be stored and transported in a manner akin to conventional fossil fuels, making it a more flexible option than options like electric power (although note the challenges in doing this identified above).
- Vehicles can be refuelled more quickly than batteries can be charged (although in some cases charged batteries can be swapped in).
- As noted above, fuel cells have already been used successfully in certain industrial and construction applications where silent and emission-free electricity generation is required.

## **Batteries**

There are many types of electric batteries in use globally, ranging from conventional lead acid batteries found in internal combustion engine vehicles (ICEVs) to very sophisticated and expensive vanadium flow batteries used in electrical grid balancing. The most common type of batteries used in electrified vehicles, mobile equipment and tools in the rental industry are lithium-ion batteries, which have an acceptable price and power-to-weight ratio. However, the development of batteries still continues at pace, and new variants and completely new batteries are likely to emerge regularly.

### Advantages

- Battery electric vehicles (BEVs) are typically zero emission at the tailpipe, and can be very low emission overall if charged using a clean and renewable source of electricity.
- Use of electric motors can provide high torque and other attractive performance characteristics.
- In some cases, the simpler powertrains and reduction in moving parts can result in significantly lower maintenance than ICEVs<sup>20</sup>.
- Charging is not dependent on new infrastructure (such as hydrogen fuelling stations and distribution networks) and can generally be undertaken anywhere with a grid connection.

### Disadvantages

- Generally, there is a need for any electric vehicle or item of equipment to remain inactive for a period in order to recharge. This can be relatively short (<1hr if fast charging is available) or more extended, such as overnight charging.
- Many electric vehicles still have a somewhat lower range or endurance than ICEVs, although this is being extended all the time and in some cases is now comparable to ICEVs.
- Similarly, many electric vehicles have lower carrying and towing capacities than their diesel equivalents, due to the additional weight of their battery. For example, the electric Renault Kangoo E-TECH has around a 20% lower payload than the diesel equivalent.
- Current generations of EV batteries demand significant quantities of scarce resources, such as lithium, nickel and cobalt. Extraction of these resources in the supply chain must be managed extremely sensitively to avoid environmental or social impacts, while end-of-life considerations are only slowly emerging (perhaps only 5% of lithium-ion batteries were being recycled a few years ago<sup>21</sup>). However, note that additional regulation of batteries, including use of recycled

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<sup>20</sup> [www.lexautolease.co.uk/lcv/van/electric-vans/going-electric-article](http://www.lexautolease.co.uk/lcv/van/electric-vans/going-electric-article)

<sup>21</sup> [www.energy.gov/sites/prod/files/2019/07/f64/112306-battery-recycling-brochure-June-2019%202-web150.pdf](http://www.energy.gov/sites/prod/files/2019/07/f64/112306-battery-recycling-brochure-June-2019%202-web150.pdf)

content and transparent and ethical sourcing of raw materials is addressed in the new EU Batteries regulation enters in to force gradually starting February 2024.

- A grid connection is generally required for recharging, and for fast charging there needs to be a specialised connection. If a grid connection is not available, operators will need to consider a conventional generator (which negates many of the benefits of electrification) or a battery-based power management solution<sup>22</sup>.

### **Sustainability of Batteries**

As mentioned above, concerns have been raised about the wider sustainability of batteries, following media coverage. Specific concerns are often voiced around:

- Extraction of cobalt in the Democratic Republic of Congo (DRC), which is used in lithium ion battery cathodes and has been linked to a number of social issues including child labour, low wages, the abuse of women and financing of warfare. The situation is further complicated because of the presence of both large scale and small-scale (artisanal) mining, and the limited opportunities for workers locally which may make mining the most attractive or viable livelihood for them.
- Environmental concerns around lithium extraction. 65% of lithium resources are in areas of medium-to-high water risk areas<sup>23</sup>, while conversely 84% of platinum resources and 70% of cobalt resources are in high-ESG risk areas. There is certainly criticism of mining companies' approaches to managing local water scarcity, for example in Chile<sup>24</sup> and Argentina<sup>25</sup>; however there are significant differences between the footprints of lithium extracted from brine in South America and lithium extracted from spodumene in, for example, Australia. Furthermore, there is scope for water saving even in brine-based production<sup>26</sup>, if more effective water management practices are introduced following customer or regulator pressure.
- Limited recycling capacity and challenges around battery re-use, recovery and recycling. There are a number of technological challenges around re-using lithium-ion batteries or the materials within them, including the safety concerns around handling batteries, a lack of standardisation of cell materials and designs and the costs and energy intensity of pyrometallurgical and hydrometallurgical recycling processes. This is an area of significant public investment and regulatory interest, such as the EU's Batteries regulation which specifically considers batteries in vehicles and other machinery and appliances.

The planned growth of electric vehicles and wider electrification envisaged by the International Energy Agency (IEA) Net Zero Roadmap<sup>27</sup> is significant, with 60% of global car sales needing to be electric by 2030 and 50% of heavy truck sales being electric by 2035. The required growth in use of transition materials, such as lithium, to meet these goals, is undoubtedly a significant challenge that will require careful management. Businesses, such as rental companies and their customers, can play an important

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<sup>22</sup> For example, <https://www.aggreko.com/en-gb/case-studies/construction/building-a-sustainable-power-solution-for-construction-site>

<sup>23</sup> Lèbre et al, 2020; Murdock et al, 2021

<sup>24</sup> Jerez et al, 2021

<sup>25</sup> Paz et al, 2023

<sup>26</sup> Mas-Fons et al, 2023

<sup>27</sup> [www.iea.org/reports/net-zero-by-2050](http://www.iea.org/reports/net-zero-by-2050)

role by carrying out appropriate due diligence and understanding the wider environmental and social implications of their purchasing and operational decisions.

### **How costly is battery technology?**

In terms of cost, rental companies are likely to often see battery-electric equipment and vehicles being somewhat more expensive than diesel-powered equipment today, at least in capital cost. However, there are a number of important considerations for operators:

- In some cases, customers may be willing to pay more for an electrically-powered asset, either because it helps them reach their own sustainability goals, or because it offers additional benefits such as silent or exhaust-free operation.
- The initial cost of acquisition is offset to some extent (or completely) by the fuel savings over the asset's lifetime. It should be noted that this payback can be complicated by the rental company purchasing the asset while the operator pays for the fuel or electricity, so the costs and benefits may accrue to different parties.
- The costs of electric technology have already fallen dramatically in many asset segments. In some cases, purchase costs of electric assets are still much more expensive than equivalent diesel-powered assets, and these are the asset segments that are slowest to decarbonise currently. For example, heavy goods vehicles (HGVs) and heavy construction equipment still have diesel power as the default, and the electric alternatives of many types of equipment are typically 50%-100% more expensive (although, note the earlier point about savings in fuel through-life). However, it is expected that by 2030 at least half of medium and heavy-duty trucks (those in excess of 6.3t) will be cheaper to buy, maintain and operate than their diesel equivalents<sup>28</sup>, and there are already numerous options for smaller electric HGVs today from both established and start-up manufacturers. For light commercial vehicles, electric variants should typically be no more than 30% more expensive than the diesel version, which is likely to be offset over the vehicle's life through reduced fuel costs.
- Total cost of ownership of electric machines is also improved by lower need for maintenance and lower need for replacement parts, when compared to diesel machines. However, resale prices of used electrical rental equipment including their batteries is still uncertain, as the market for this equipment is relatively immature. Batteries may also be re-purposed in coming years into different applications (such as static energy storage).
- Rental companies should ensure they, and the renters/operators, carefully follow the manufacturer's instruction about battery maintenance, especially with regards to over-charging or over-discharging, including under different temperature conditions. Most manufacturers will provide battery management technology to prevent damage to the battery, but if this is not in place, or fails, the battery's performance and lifespan can be very seriously affected.

### **Case Study: Light commercial vehicle fleet electrification**

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<sup>28</sup> United States Department of Energy, 2022

Sunbelt Rentals, an equipment rental company owned by Ashtead Group, has recently announced the purchase of over 650 electric Ford F-150 Lightnings for its USA division. The electric F-150's will contribute significantly to Sunbelt Rental's plan to reduce emissions by 35% by 2030. The company will also supply and install a large number of fast chargers at employee's homes.

The F-150 Lightning starts at around \$50,000<sup>29</sup> with a towing capacity over 3.5t but is currently only available in the USA (although expected to be available in Europe shortly). However, a number of other manufacturers including Tesla, Rivian and Chevrolet expect to release electric pickup trucks in 2023 or 2024, and these offer a towing alternative to the diesel vans many rental companies currently use (note that most electric vans have a reduced towing capacity compared to the diesel alternatives – some of the leading options currently are the Renault Kangoo E-TECH with 1,500kg towing capacity and the Ford e-Transit with 2,000kg capacity<sup>30</sup>).

### **Site Power**

Although the energy needs of vehicles and mobile equipment are significant, there are also other energy needs on a construction site. Site accommodation, small tools, lighting and other energy needs exist, some of which can be satisfied relatively easily with a grid connection.

However, for sites that cannot access a grid connection, or where an uninterruptible power supply (UPS) is needed, site power is often supplied by a diesel generator, which can be fuelled from the same bowser as the mobile equipment.

More sophisticated site power solutions are now available however, with many options in the 60-90 kWh range right up to large remote charging options such as Volvo's mobile Power Unit<sup>31</sup> which can offer 600V fast charging and 400 kWh of energy.

### **Example: Key questions for rental companies to ask customers considering integrating electric mobile equipment into site operations**

1. What class of equipment do you need? If under 10t, there are likely to be many effective electrical options. Over 10t the choice may be more restricted.
2. Will you have a grid connection available? If not, can one be made available earlier than initially planned in the construction programme? Can 3-phase power be made available for faster charging?
3. How will you recharge the equipment? Can you charge the machine overnight (i.e. will a machine only require 1 battery's worth of energy a shift) or will recharging be required during the day (due to a demanding operation, such as breaking out reinforced concrete).
4. Can you move the machine to the charger (either under its own power or on a transporter)? Is this feasible within the working shift, or do other restrictions prohibit this e.g. vehicle movements limits on urban sites?

### **Summary of Vehicles, Equipment and Site Power Options**

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<sup>29</sup> [www.ford.com/trucks/f150/f150-lightning/](http://www.ford.com/trucks/f150/f150-lightning/)

<sup>30</sup> [www.corporate.ford.com/articles/products/ford-e-transit-custom.html](http://www.corporate.ford.com/articles/products/ford-e-transit-custom.html)

<sup>31</sup> <https://www.volvoce.com/europe/en/about-us/news/2023/volvo-powers-up-for-ec230-electric-and-l120h-electric-conversion/>

There are many ongoing developments in the field of sustainable energy for transport. Significant effort and investment has already been put into biofuels, and to a certain extent they are already a mature component of the energy mix through their blending into conventional fossil fuels.

Hydrogen is at a lower stage of maturity than biofuels, and significant questions remain about its appropriateness in applications that can be served by BEVs. At a small scale, hydrogen has been used on sites for some time (e.g. hydrogen fuel cells used as power packs on underground rail infrastructure<sup>32</sup>). However, it may be appropriate for larger scale applications where:

- Recharging of batteries is impossible or impractical
- There is significant value from retaining combustion technology
- Heavy work is required over an extended working day, beyond the capacity of batteries

The sustainable energy technology with the greatest scope for sustainability in the rental sector appears to be battery electric, however this is very dependent on the type of equipment and its duty. In some classes of equipment, battery electric products have been mainstream for some time in specific applications (e.g. lighting towers) or are being quickly adopted (e.g. mini excavators<sup>33</sup>). However, rental companies and clients are still finding wider adoption challenging without early and comprehensive planning for electric equipment integration into the work plan and site.

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<sup>32</sup> <https://www.tunnelsonline.info/news/hs2-hails-successful-hydrogen-generator-trial-9866656>

<sup>33</sup> 23 OEMs are already producing battery electric excavators <8 tonnes and 15% market penetration is expected in the USA by 2029 - <https://www.constructionequipment.com/sustainability/article/21460555/pathway-to-clean-energy-construction-equipment>