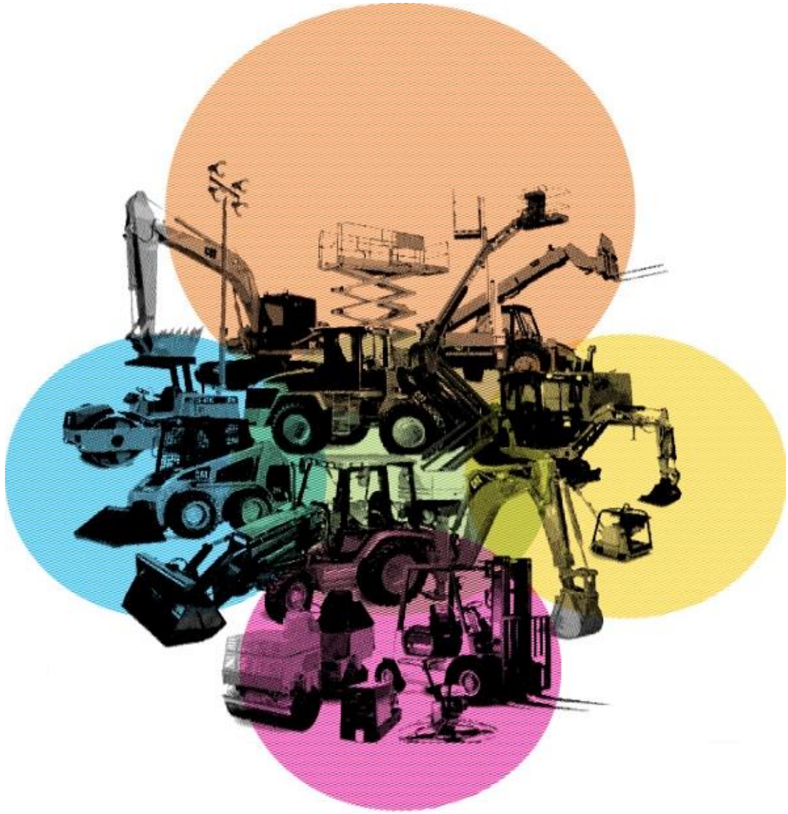
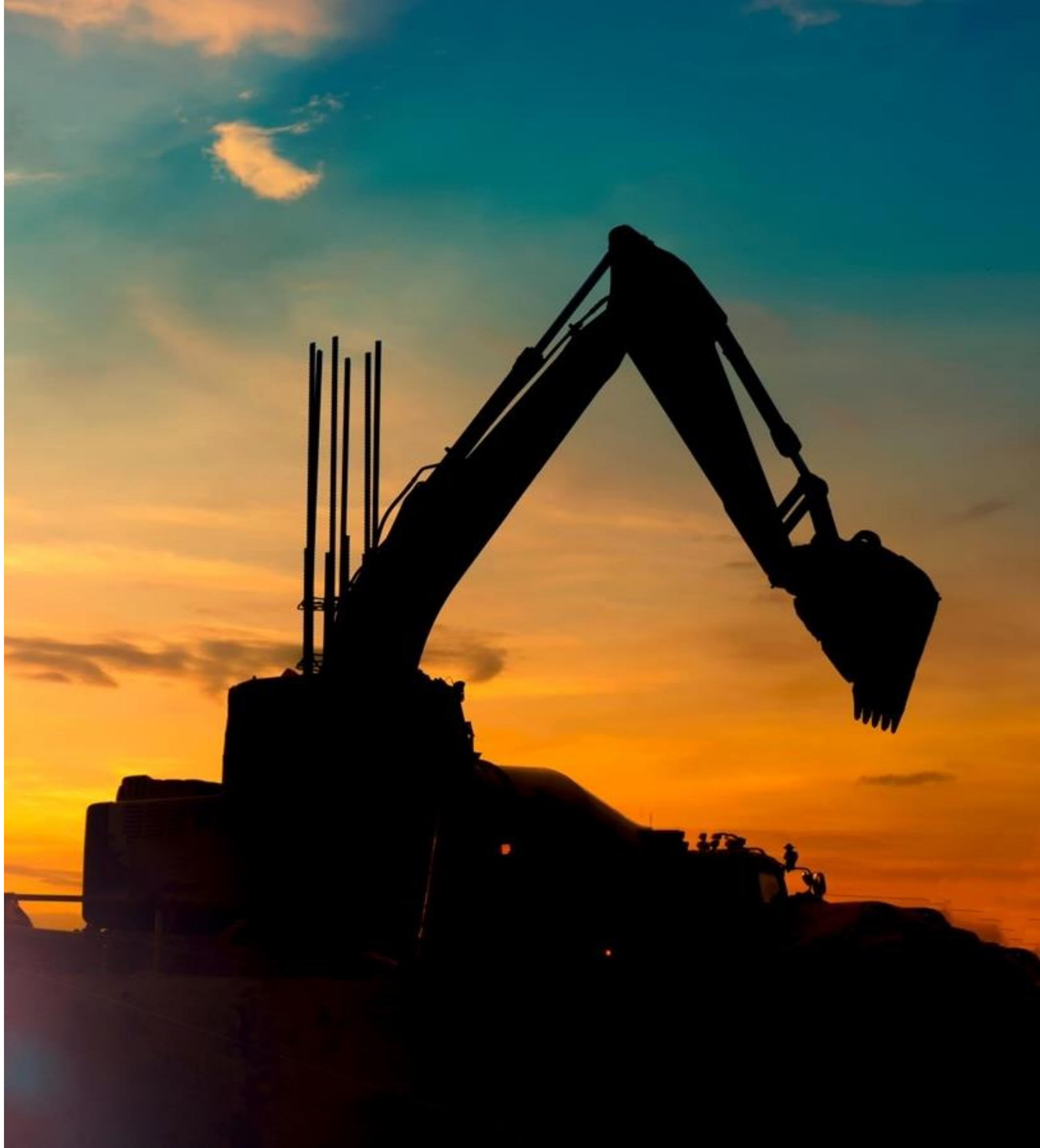
European Rental Association

Energy Transition in Rental

Report synthesis
June 2025



Objectives, scope of work and methodology



Objectives of this report

1 | Low-carbon solutions options and adoption barriers

- Identify the most appropriate type of energy depending on equipment types
- Determine the barriers to the alternative types of energy adoption

2 | Customer requirements and value proposition

- Detail the challenges and opportunities of the energy transition from the customers' point of view
- Identify new product and services offering

3 |Standards and training for battery-electric solutions

- Summarize current trends in batteries and infrastructure to articulate the rental industry standards needs
- Identity training needs

4 | Revision of the rental TCO model

- Provide recommendations to update the TCO model based on the conclusions of the first three phases

6 low-carbon solutions have been analyzed to identify the solutions with the highest potential to replace fossil fuel equipment

6 low-carbon alternatives to fossil fuels have been considered during this project. This analysis was conducted through:

- A comprehensive **literature review**
- **28 interviews** with 9 rental companies, 13 OEMs, 5 rental customers and 2 associations
- **Analysis of 7 responses provided by rentals to an online survey** sent in the context of this study
- **Analysis of 17 responses provided by OEMs to a second online survey** sent in the context of this study

Low-carbon solutions analyzed

Battery electric		Machines powered on electric batteries (either 100% battery or hybrid), with different charging solutions to be explored (e.g. charging standards, fast charge, swappable batteries). Although it is not the core of the analysis, cable connected solutions may also be assessed for specific use cases.
Biofuels	**HVO**	Hydrotreated Vegetable Oil. A diesel fuel produced by hydro processing renewable feedstocks, like fats and oils, defined as a renewable diesel, that meets the European Renewable Energy Directive II criteria for biofuels.
	Biodiesel	Diesel fuel produced by transesterification of renewable feedstocks, like fats and oils, that meets the European Renewable Energy Directive II criteria for biofuels. Using biodiesel blends higher than B7 (i.e. 7%) requires modifications on engine fuel injection systems and filters.
Hydrogen	**Fuel cells**	Hydrogen used in fuel cells or internal combustion engines, that meets the European Renewable Energy Directive II criteria for low carbon hydrogen.
	ICE	
Synthetic fuel (e-fuel)		Liquid synthetic fuels meeting the European Renewable Energy Directive II requirements of **RFNBOs** (Renewable Fuels from Non-Biological Origin), also called **e-fuels** (e.g. e-ammonia, e-methanol).

This work draws on the participation of >35 industry stakeholders

Rentals and representatives

- 9 rentals were interviewed and 7 of them also completed the survey
- Headquarters are based in 6 different European countries
- The panel of companies approached includes companies of all sizes: 3 with revenues of less than 500 million euros, 2 with revenues of between 500 million and 2,000 million euros, and 4 with revenues exceeding 2,000 millions.*

OEMs

- 13 OEMs were interviewed and 9 of them also completed the survey
- 8 other OEMs (not interviewed) also responded to the survey
- Headquarters are based in 9 different European countries and 3 from outside of Europe
- The panel of companies approached includes companies of all sizes: 7 with revenues of less than 500 million euros, 5 with revenues of between 500 million and 2,000 million euros, and 3 with revenues exceeding 2,000 millions. *

Customers and associations

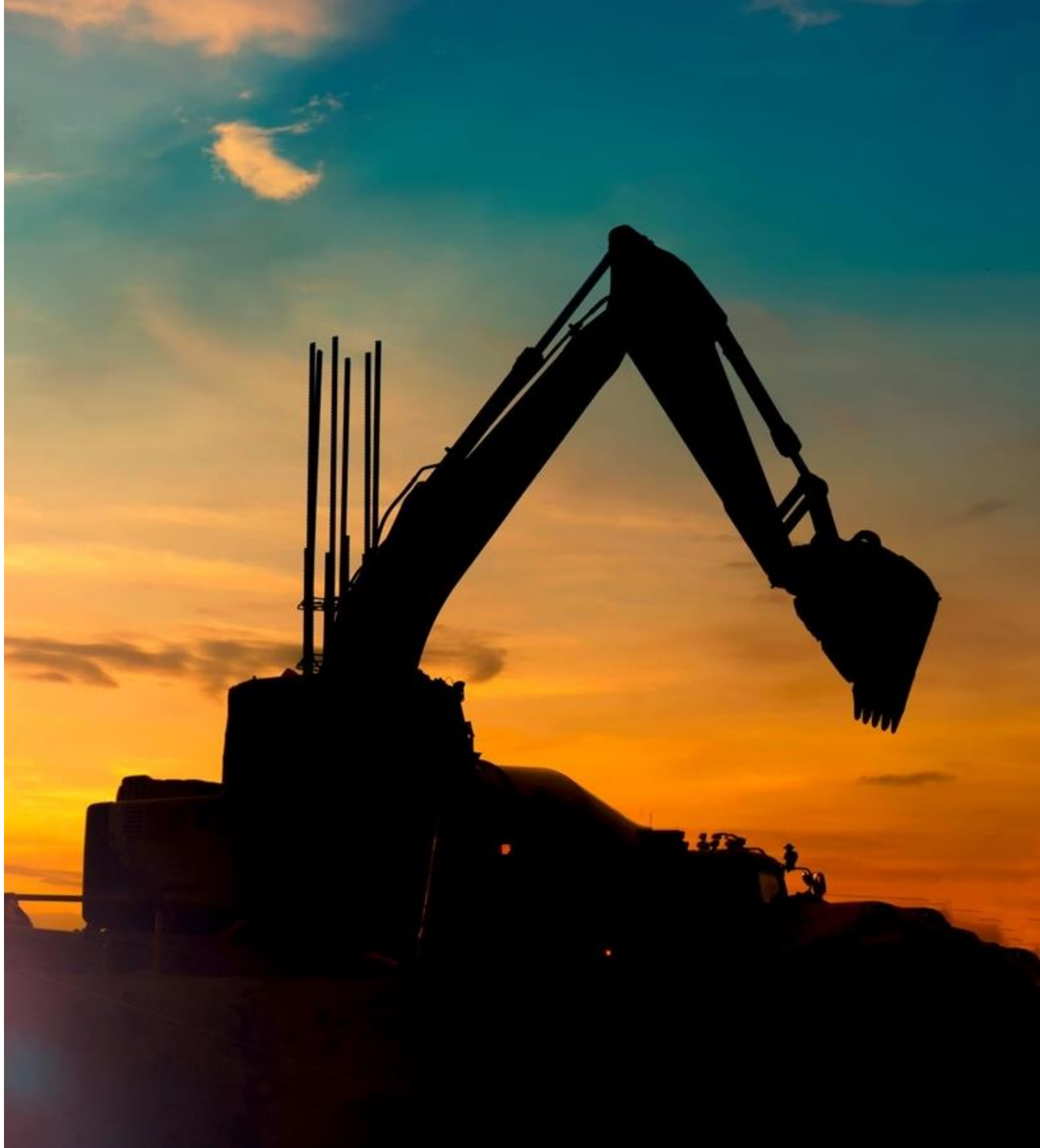
- 5 customers in construction sector were interviewed
- 2 associations and public authorities were interviewed

**2023 revenues*

CAPTION: Data collected through interviews and/or survey

 ERA Energy Transition in Rental – Sources: EY analysis on data collected through OEM and rentals interviews, survey and on companies' annual reports.

Report synthesis



The ERA energy transition project aims at facilitating the energy transition in the rental industry and ultimately contributing to achieving European decarbonization targets

The energy transition is necessary to achieve the European Union's reduction targets set out in the "Fit for 55" package, defined under the Paris Agreement. It is defined as the shift from using fossil fuels to cleaner, renewable energy sources, aiming for a more sustainable and environmentally friendly energy system.

Non-road mobile machinery impact on climate

Non-road mobile machineries, or off-road equipment*, is responsible for 108 Mt CO2e per year, which **represents 3.1% of the EU's Greenhouse Gas (GHG) emissions.**

EU GHG emissions' reduction objectives

The EU "Fit for 55" package sets greenhouse gas reduction objectives of **-55% by 2030 and aims to achieve net-zero by 2050** (1990 baseline).

The Non-Road Mobile Machinery sector falls under this objective through the Effort Sharing Regulation (ESR), with a global objective of reducing **CO2e emissions by 40% by 2030** (2005 baseline)**.**

The energy transition supports four key objectives:

- **Decarbonize rental activities**
- **Comply with local, national and European regulations**
- **Meet customers' expectations**
- **Strengthen European energy independence**

 *Non-road mobile machines included are those used in industry and construction, and ones used for mining and airport operations, machines used in commercial, agriculture and forestry, fishing, residential, inland waterways, rail and military sector. Sources: [1] T&E - Reducing emissions from non-road mobile machinery ; [2] Fit for 55 – Consilium, Effort sharing 2021-2030: targets and flexibilities - European Commission

The rental industry can play a pivotal role in the energy transition of the equipment sector

Rental companies and original equipment manufacturers are already investing and innovating to reduce air pollutants and improve asset efficiency. In addition, the rental industry can play a decisive role in the sector's energy transition.

The rental industry can facilitate the energy transition

with OEMs

Share **feedback** and contribute to products' continuous improvement

Facilitate **economies of scale** by increasing volumes of low carbon equipment purchase

with clients

Offer **flexibility** in the adoption of low carbon solutions and risk mitigation

Share **expertise** on the deployment of low-carbon solutions

Develop **new services** related to energy management and supply (e.g. energy as a service)

with public authorities

Express clear advocacy messages at local, national and European levels on **regulatory and incentive** frameworks evolutions

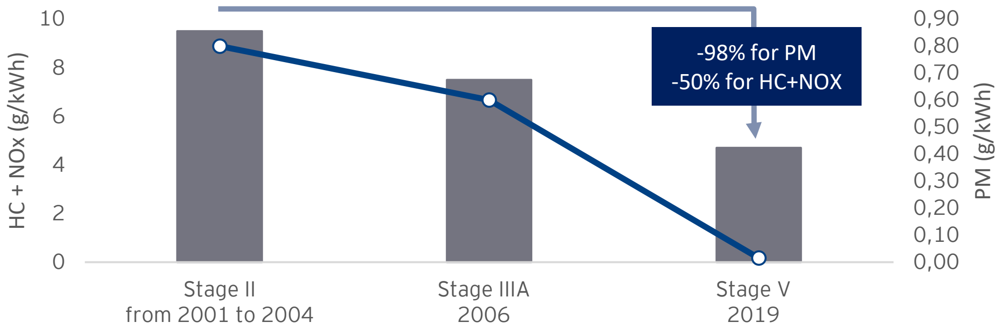
Each rental company can foster the transition in its activities

- Structure and market the low-carbon service offering for clients
- Monitor technology and regulatory evolutions to inform fleet investment decisions
- Investigate fleet financing options (sustainable finance)
- Develop new skills to adapt the workforce to the energy transition (operations & maintenance, sales)

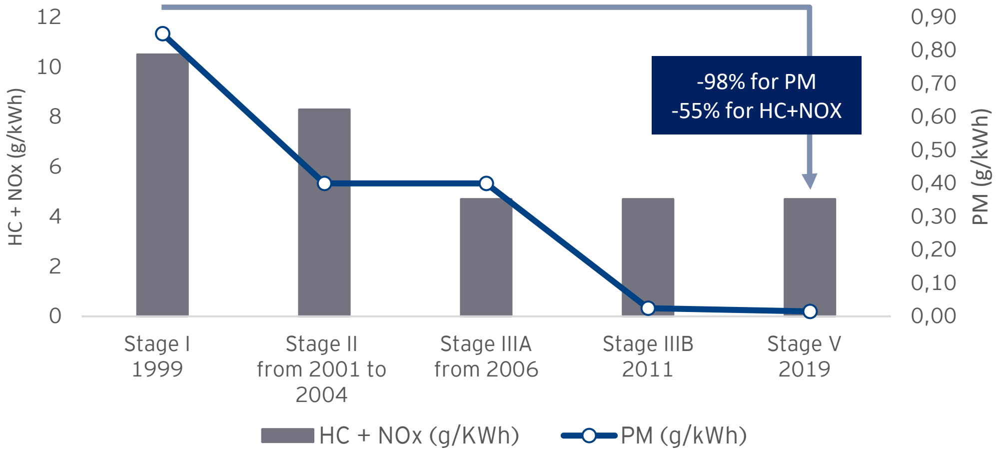
The EU Non-Road Mobile Machinery (NRMM*) regulation sets air pollutant emission limits while EU ETS 2 will increase fossil fuel prices and foster the transition to low carbon solutions

Emission limits from Stage I to Stage V

Emission limits for **19 to 37 kW engines**



Emission limits for **37 to 55 kW engines**



NOx (nitrogen oxides), PM (particulate matter) and HC (hydrocarbon).
No emission limits fixed by Stage IV for 19 to 55kW engines.

EU ETS Implementation

- The upcoming EU ETS2 will introduce a carbon price to non-road fuels used by industry and construction, starting in 2025. This will become fully operational in 2027.

Impact on OPEX

+10%

EU ETS2 will increase diesel fuel OPEX by ~10%, from 2028

when considering a price of €45/tCO2e for allowances
(price cap announced by the EU for the 2027-2029 period)

Although they both refer to 'Non-Road Mobile Machinery' and aim to reduce emissions, the EU ETS focuses on greenhouse gases from specific sectors (such as manufacturing industries and construction), while the NRMM regulation targets pollutant emissions from off-road machinery. These regulations also apply to hand-held equipment and power generation sets.

 |*NRMM include equipment such as construction machinery (excavators, bulldozers), agricultural equipment (tractors, combine harvesters), material handling machines (forklifts, cranes), generators, as well as gardening and landscaping machines.| Sources: Regulation (EU) 2016/1628; European Stage V non-road emission standards; NRMM Guide – Pages.; ETS2: buildings, road transport and additional sectors, Emission Standards: Europe: Nonroad Engines

Some national and local regulations prohibit the use of internal combustion engine machines or impose GHG emission caps, financial incentives are being implemented

Regulations limiting the use of ICE

Climate and environmental requirements for the City of Oslo's construction sites (NO):

Contains standard climate and environmental requirements for the City of Oslo's construction sites, as part of the City's ambitions to have fossil-free and zero-emissions construction sites from 2025.

Focus on next slide

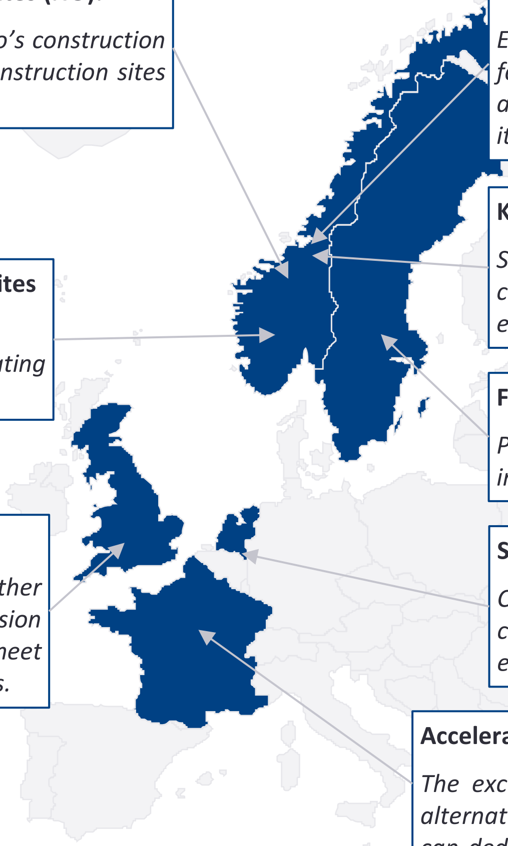
Prohibition on the use of mineral oil for heating and drying on construction sites for buildings (NO):

From January 1, 2020, use of mineral oil (oil from fossil sources) for heating buildings has been prohibited.

London's Low Emission Zone for Non-Road Mobile Machinery (UK):

Initiative aiming at reducing air pollution from construction equipment and other non-road machinery operating within the city. The zone sets strict emission standards for NRMM used on construction sites, requiring machinery to meet specific criteria for particulate matter (PM) and nitrogen oxides (NOx) emissions.

It is important that regulations are effectively enforced to ensure a fair level playing field.



Financial incentives for low-carbon solutions

Enova Support Scheme (NO):

Enova, a company owned by Norway's Ministry of Climate and Environment, aims to facilitate the country's transition to a low-emission society by managing the Climate and Energy Fund, providing grants to the adoption of low-carbon equipment through its "Emission-free construction machinery" program.

Klimasats Financial Support Scheme (NO):

Support scheme for municipalities and county authorities to help developing low-carbon projects. It has provided funding for zero-emission construction sites and zero-emission machinery.

Financial support from the Swedish Energy Agency (SE):

Possibility of applying for aid from the Swedish Energy Agency: 20-50% of the investment cost for machines with an output of more than 15 kW.

Subsidy for Clean and Zero Emission Construction Equipment (SSEB) (NL):

Construction companies in the Netherlands, that own equipment, and/or rent out construction equipment can apply for this subsidy if they retrofit or buy zero-emission equipment.

Accelerated depreciation of investments in less polluting non-road machinery (FR):

The exceptional deduction scheme allows companies to invest in non-road vehicles using alternative fuels to non-road diesel. Companies can deduct 40% of the original value, SMES can deduct 60%. This scheme applies to companies in construction, public works, and other sectors, for vehicles acquired new between January 1, 2024, and December 31, 2026. The vehicles must meet emission criteria and not be intended for road use.

 Sources: EY Analysis on local regulation, T&E - Reducing emissions from non-road mobile machinery; ERA Technical committee Member

Oslo’s emission free construction sites policy shows the key role of public authorities as buyers, regulators and facilitators

City councils have three main levers

Public procurement

- **Oslo City Council accounts for 20%** of the local market’s contract value.
- In 2019, **Oslo City Council introduced procurement criteria** to encourage municipal projects to use emission-free construction.

Regulation

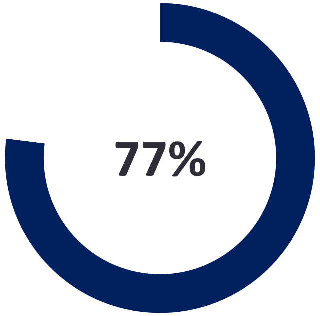
- From 2025, **emission-free construction equipment is mandatory for all public projects.**

Facilitation

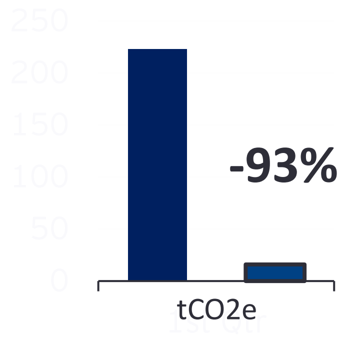
- The Oslo City Council is **active in industry initiatives that facilitate knowledge exchange and good practice sharing across Europe** (C40 Cities’ VISIBLE project, FutureBuilt project).

- SMEs, which make up 99% of the construction sector, need funding and assistance.
- Oslo **has phased in environmental requirements gradually** to accommodate smaller businesses.

Results achieved in Oslo



of municipal building sites are emission-free



GHG emission reduction

on the Sophie’s Minde’s site compared to conventional building sites

While the optimal choice of low-carbon solution mainly depends on the local context, electric batteries and HVO emerge as two high potential solutions

The appropriate choice of low carbon solutions mainly depends on local criteria at site and city levels

European & national levels*

To date, construction equipment **regulations require non-GHG pollutions reduction**

The implementation of EU-ETS in the construction sector will impose a price on GHG emissions **from 2027**

Region & city level

Some European cities are pioneering the energy transition by imposing **decarbonization or electrification mandates on construction sites**, both as buyers (contractual clauses) and regulators, as well as by providing grant schemes

Site level

Client requirements, ease of access to a power grid, and temperature conditions are to be assessed at the project level

This determines **low carbon solution choices** *see zoom next slide*

Electric batteries and HVO are the two low-carbon solutions with the highest potential to fossil fuel consumption reductions in the equipment sector

	Fossil fuels	Battery electric	Biofuels		Hydrogen		Synthetic fuel (e-fuel)
			HVO	Biodiesel	Fuel-cell	ICE	
CAPEX	●	◐	●	●	○	◐	●
OPEX	◐	●	◐	◐	○	○	○
Operations	●	◐	●	◐	◐	●	●
Energy supply	●	◐	◐	◐	○	○	○
Environment	○	●	◐	◐	●	◐	◐
Potential for fossil fuel consumption reductions	-	●	●	◐	◐	◐	◐
ACTIONS**		*Installation of charging infrastructure, safety provisions*	*Installation of HVO fuel tanks in branches*				

Competitivity and availability trends:

- **Battery electric**: currently higher TCO but positive perspectives on battery cost ***Focus on next slides***
- **HVO**: currently competitive (no additional CAPEX compared to diesel, moderate OPEX premium) but faces a supply shortage risk

● Favorable ◐ Mixed ○ Unfavorable

ERA Energy Transition in Rental| * more initiatives take place at the city level than at national level, this is the reason why region & city level is a dedicated category; ** examples only, more details to be found in the report | Sources: EY analysis from literature research, OEMs data, interviews

Note:

- The assessment can vary across countries (e.g. some countries have a strong hydrogen development policy and thus faster infrastructure development and cost reduction)

Several battery chemistries are available on the market, with LFP and NMC batteries dominating in Europe, North America and China

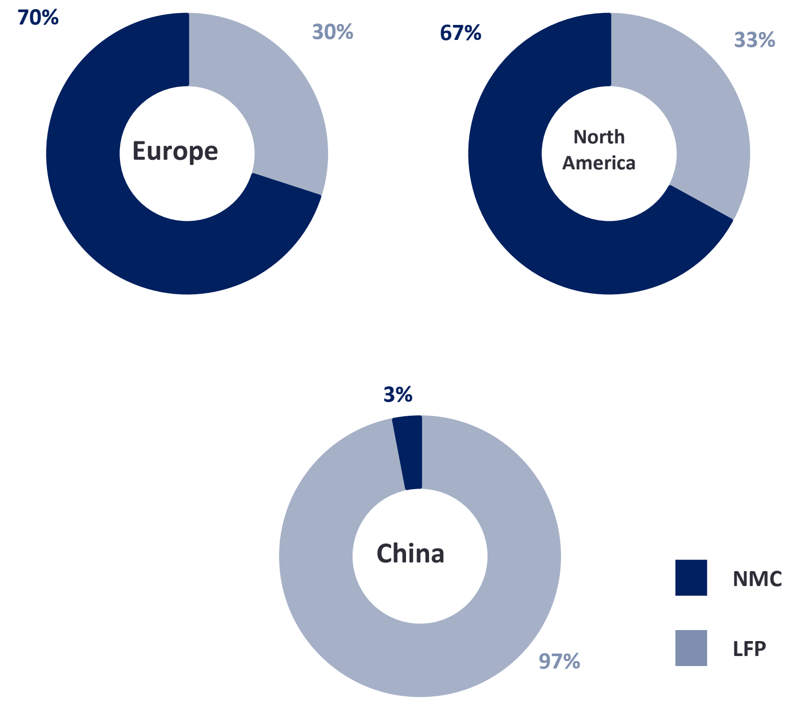
Three types of batteries have been analyzed (Pb-Acid, LFP, NMC)

- Several type of batteries exist on the market. The main developed types are Lead-acid (Pb-Acid) batteries, LFP (Lithium Ferro Phosphate) and NMC (Nickel Manganese Cobalt) batteries.
- These batteries differ in their chemistry, the materials used in their manufacturing, their cost, safety of use, lifespan, charging duration, energetic performance, and recyclability.

	Content
Lead Acid	Lead and sulfuric acid
LFP *Lithium Ferro Phosphate batteries*	Lithium, iron and phosphate as the cathode material
NMC *Nickel-Managanese -Cobalt batteries*	Nickel, manganese and cobalt as the cathode material

NMC dominates the electric machines market in Europe and North America while LFP is far more developed in China

Market share by battery chemistry and by region



 ERA Energy Transition in Rental| Sources: [1] The Electric Future of Construction: EV Machines On The Rise, IDTechEx, 2024.

Battery chemistry choices consist in a trade-off between performance and costs — when high performance is unnecessary, machines can be equipped with lower-cost batteries

While NMC batteries offer the highest performance, particularly due to their higher energy density and lower energy losses, they face growing competition from LFP batteries, which have lower manufacturing costs and steadily improving performance.

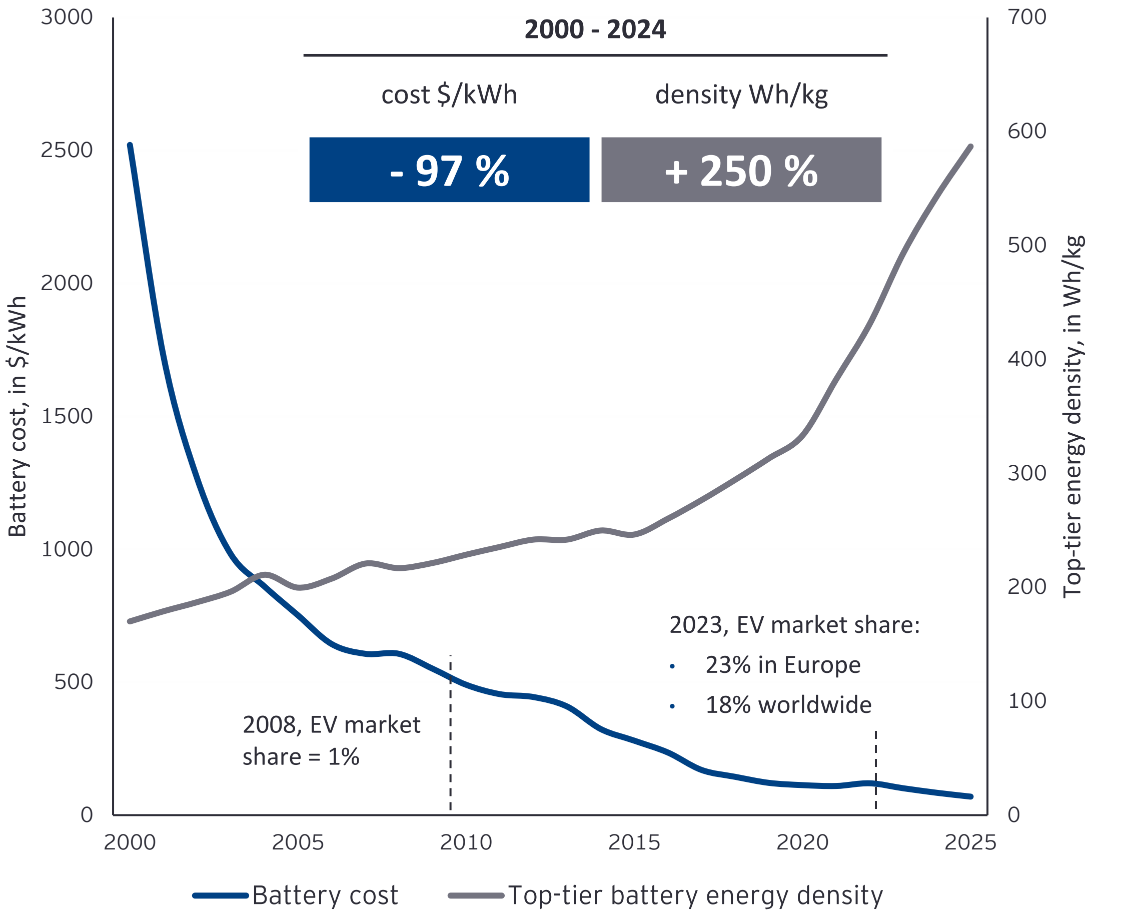
Chemistry	Energy density	Cost	Safety	Charging speed	Lifespan	Specific power	Energy losses	Manufacturing GHG emissions	Recyclability	Material criticality
Lead acid *Low performance, low cost*	35-40 Wh/kg	Cheaper than lithium batteries	Low hazard of thermal runaway Made of toxic material, can leak	4 times slower than LFP	500-1,000 cycles	Energy capacity drops at high discharge rate	Self-discharge rate 5 times greater than for a lithium battery 70% to 85% charging efficiency	2 to 4 times less GHG emissions compared to Li-ion batteries	Widely recycled	No need for critical materials
NMC *High performance, high cost*	150-220 Wh/kg ~1.7x higher density compared to LFP	Manufacturing cost: ~2x the price of lead acid batteries	Thermal runaway : 210°C Fire risk at high charge	3h typical charge time Possibility to be fast-charged	1,000-2,000 cycles	Max discharge rate: 1C-2C*	Energy losses at high temperature 95 % charging efficiency	84kgCO2e/kWh	Recycling is economical at scale	High need for critical materials
LFP *Average cost and performance*	90-120 Wh/kg	Manufacturing cost: $75.2/kWh ~1,5x the price of lead acid batteries	Thermal runaway : 270°C: does not require temp. control Stable, less toxic materials than NMC	3h typical charge time Possibility to be fast-charged	2,000-6,000 cycles	Max discharge rate: 1C-2C	Energy losses at low temperature 95 % charging efficiency	35kgCO2e/kWh	Not economical at scale yet	Low need for critical materials

Low performance — High performance

ERA Energy Transition in Rental| *Discharge rate. A discharge rate of 1C means that the battery can fully discharge in 1h, In 30min if 2C, in 15min if 4C, … | Sources: EY Analysis, IEA, Power Sonic, ELB Energy Group, CoreMax; ; The Rise of Batteries in Six Charts and Not Too Many Numbers - RMI ; Battery lifecycle emissions by chemistry, IEA, 2024

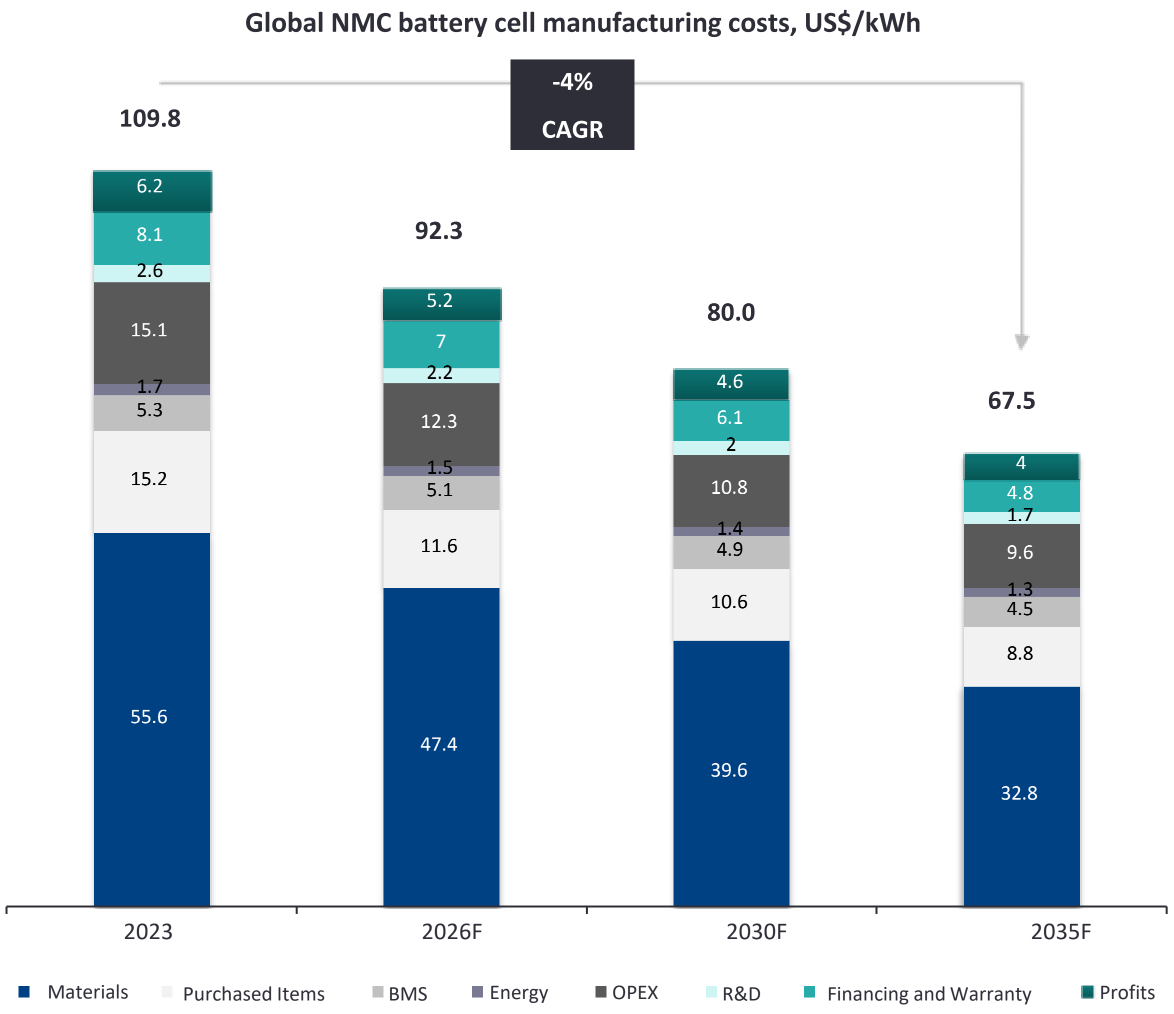
In the electric vehicle market, simultaneous decline in costs and improvement in energy density is making electric batteries increasingly capable of meeting user requirements

EV batteries costs keep on falling while energy density rises



Costs displayed apply to the EV industry. The equipment sector produces lower volumes and therefore pays higher prices. Costs vary according to voltage. In addition, the two sectors use different suppliers.

Both NMC and LFP manufacturing costs are expected to decline

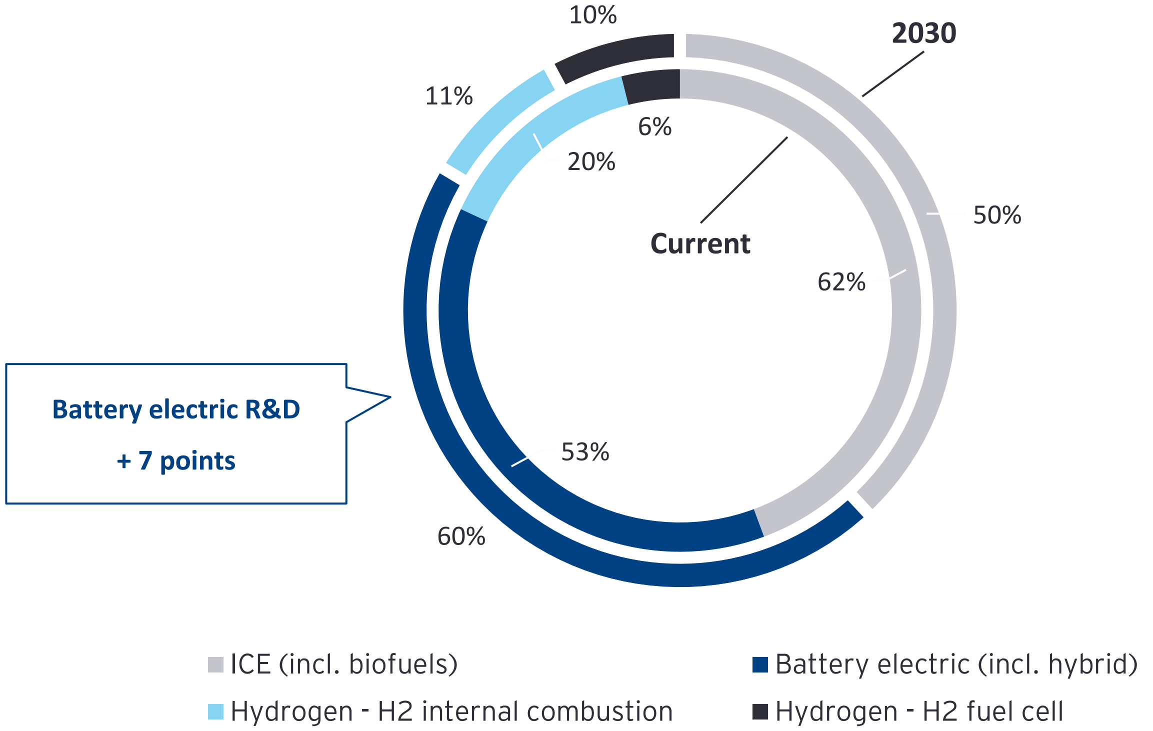


ERA Energy Transition in Rental| Sources: International Energy Agency; EY Analysis (see next slides for details); The Rise of Batteries in Six Charts and Not Too Many Numbers – RMI, Tracking global data on electric vehicles - Our World in Data, European Market Monitor: Cars and vans 2024 - ICCT

Projected R&D shares per technology among OEMs suggests that electric batteries will be the top priority technology, closely followed by ICE (including biofuels)

According to the survey conducted as part of this study, OEMs are planning to increase R&D share dedicated to low-carbon solutions (2030 horizon) – especially for electric batteries.

Average projected R&D share (%) per technology (current vs 2030)



Key take-aways

- R&D related to ICE, including biofuels, currently receives a higher share (44%) than electric batteries (38%).
- However, while R&D dedicated to ICE is expected to decrease by 13% by 2030, R&D for electric batteries is projected to increase by 7%.
- **By 2030, R&D for electric batteries is expected to reach 46%, compared to 38% for ICE.**
- Other low-carbon technologies, such as hydrogen, are prioritized by a lower number of OEMs*.

**ICE as Internal Combustion Engines includes fossil fuel and biofuels.*

ERA Energy Transition in Rental | * caution is advised when analyzing hydrogen-related figures due to the low number of respondents on this field (6) | Survey sample: 17 equipment manufacturing companies, European based in majority, surveyed between December 2024 and February 2025

Electrification provides GHG emissions' reduction compared to fossil fuels during use phase

Average data from ERA carbon reporting project

-84%*

average GHG emissions reduction during use phase

achieved by battery electric machines vs. diesel ICE

Sample: Boom lifts, Compressors, Dumpers, Forklifts, Min & mid excavators, Pumps, Scissor lifts, Sked steers, Wheel loaders, Telehandlers

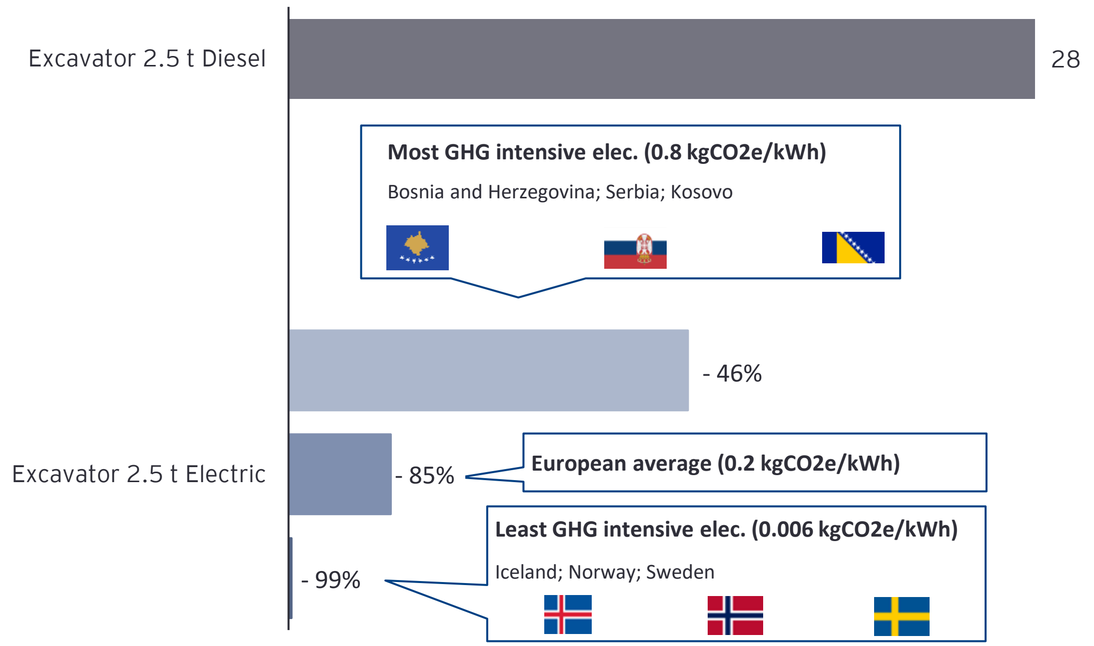
European average power grid GHG intensity

Illustration for a 2.5 tons excavator

2.5-ton **electric excavators allow for approximately an 85% reduction in direct GHG emissions compared to diesel excavators**, due to both the lower carbon intensity of electricity compared to diesel and the higher energy efficiency of electric engines.

When calculating in **Life Cycle Assessment (LCA)**, which evaluates environmental impact throughout the entire lifecycle—from raw material extraction to disposal—**the average GHG abatement is around 60%** (European power grid average).

Direct GHG emissions (Scope 1 & 2) – kgCO2eq / rental day**

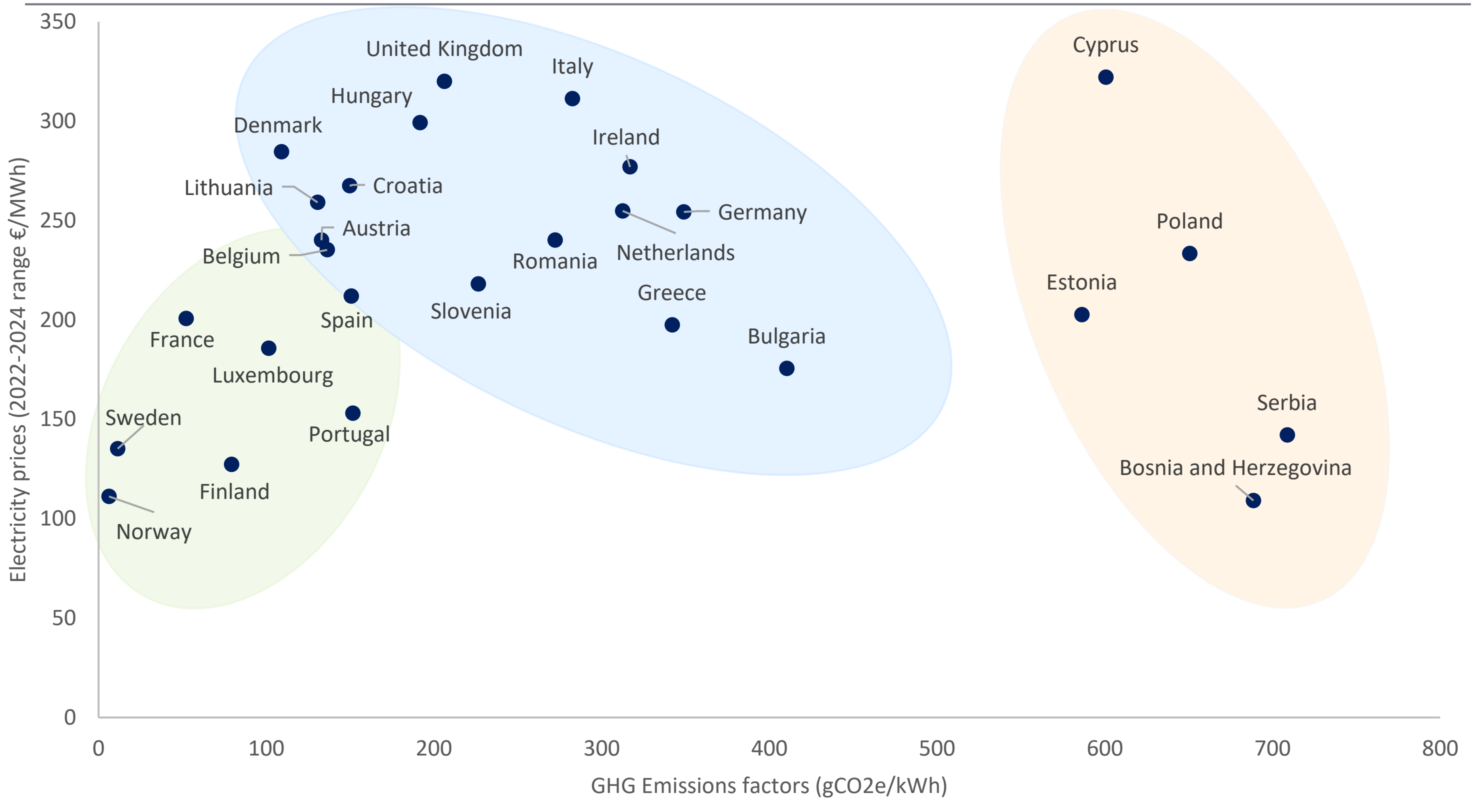


 ERA Energy Transition in Rental| *EY Analysis, *excluding transportation: device manufacturing, emissions in operation (energy), end-of-life emissions | Sources: ERA carbon reporting project; IEA Emissions database, 2021; Equipment manufacturers emissions reporting; EY analysis

Electricity prices and carbon impact per kwh greatly vary from one country to another

Electricity carbon intensities in Europe vary by more than x100 while electricity prices vary by x3.

Electricity prices and carbon intensity in Europe [1,2,3]



Competitiveness level for electric batteries deployment:

- Least competitive countries (high elec. prices and/or carbon intensity)
- Average level of competitiveness
- Most competitive countries (low elec. prices and carbon intensity)

Additional information

- Due to European decarbonization objectives, electricity carbon intensities are decreasing in Europe. **Generating one kilowatt hour is estimated to have emitted, on average, 19% less CO2 in 2023 than in 2022 and 35% less than a decade ago.[4]**

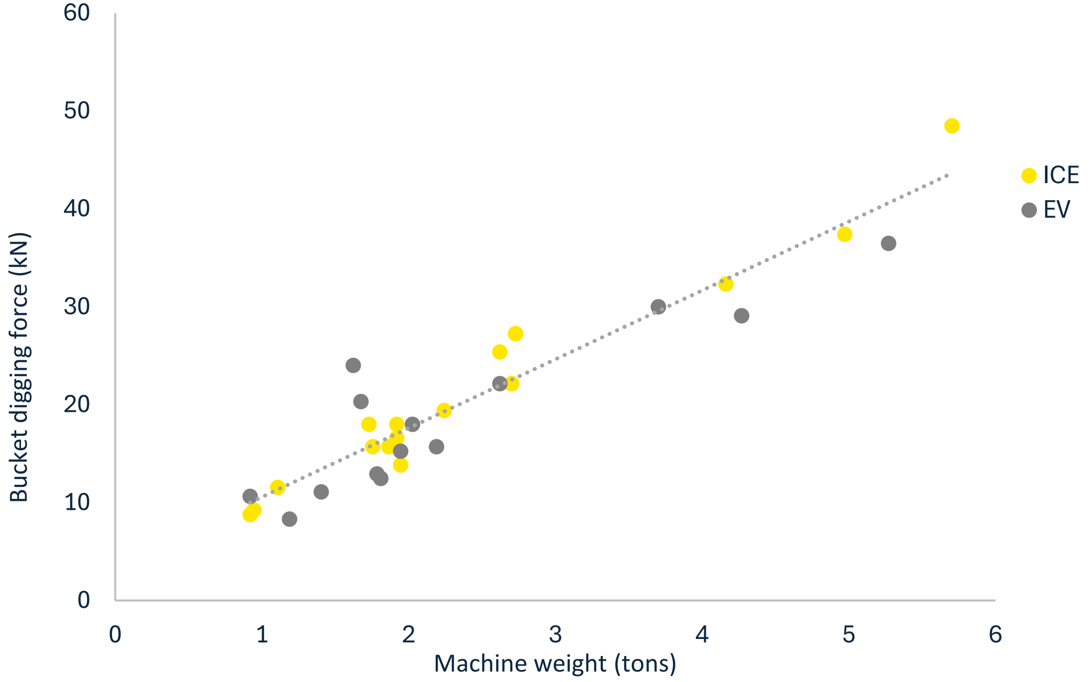
ERA Energy Transition in Rental| Sources: [1] Eurostat, Electricity prices for non-household consumers, including taxes and levies, Average price between 2022 and 2024; [2] IEA Emissions database, 2021; [3] For UK : UK: non-domestic prices for electricity 2023 | Statista; [4] European Environment Agency

Battery electric machines are already available for most of the operational needs

Electric excavators can provide the same digging power as ICE equipment.

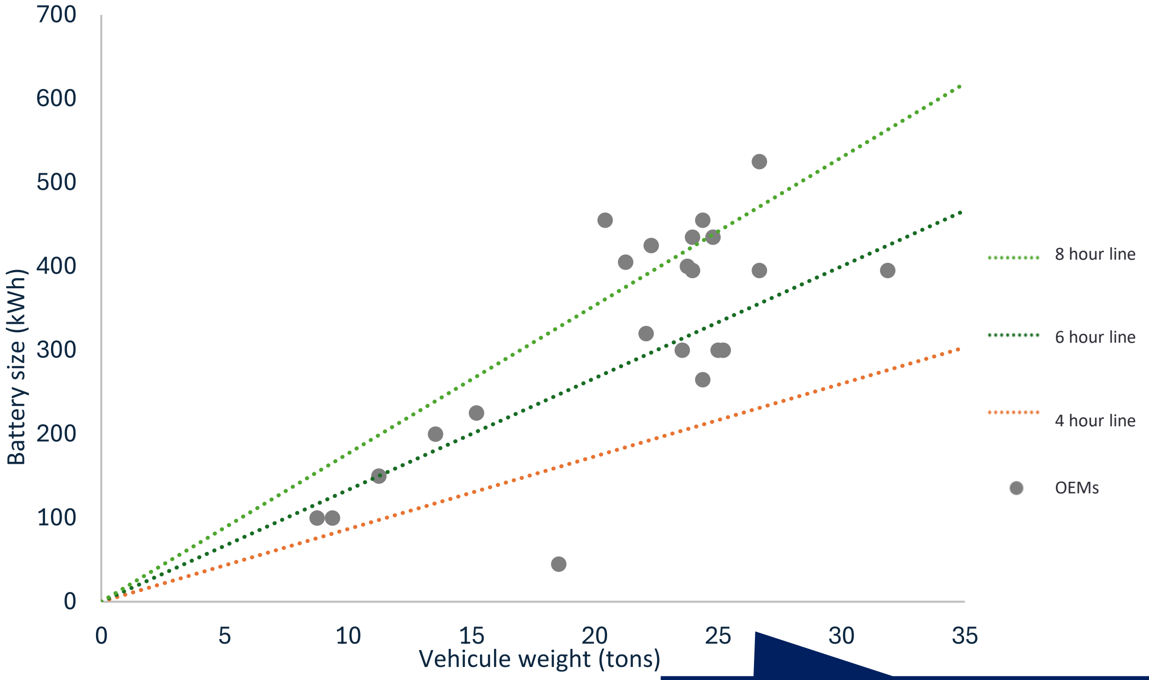
The autonomy of battery electric excavators is not a barrier to adoption for a majority of use cases. Sectoral data shows that most rental excavators (<10t) are used for up to 5 hours per day, aligning with the runtime of existing electric solutions (> 5h).

Electric digging machines up to 6t provide equivalent performance compared to ICE*



**Analysis based on engines publics technical information*

Runtime is up to 8hours for excavators up to 25t*



ERA Carbon reporting project data reveals that **excavators are commonly used 3-5 hours/day**

Most rental excavators in Europe are <10 t

The 3 main energy transition challenges identified are the CAPEX premium, the access to energy infrastructure, and the standardization and practicality of use

1	2	3
CAPEX premium	**Energy infrastructure**	**Standardization & practicality of use**
Battery electric and hydrogen powered (fuel cells) machines' investment premium is in a 30% - 100% price premium range	*Electricity supply in operations is a challenge, with grid connection times ranging between several months and a year in urban areas and being rare in remote locations**	*This category encompasses both the lack of harmonization in charging protocols and the impact of refueling / charging (time and frequency)*
"clients do not want to pay a ***price premium****"* *"****CAPEX*** *are up to x2-2.5 today depending on the products"*	*"power needs for the construction site is* ***larger than the building's needs*** *after construction"* ***"infrastructure is not there*** *to provide this kind of equipment." (hydrogen)*	*"every machine must have its* ***own onboard charger****"* *"the challenge is for* ***fast charge where the lack of standardization*** *is an obstacle"*
economics	*operations*	

Battery electric solutions can be prioritized on stationary sites with grid access, while biofuels and H2 could be preferred on remote sites with mobile activities

The appropriate choice of low carbon solution mainly depends on local criteria at site and city levels

Operational conditions

- Urban
- Stationary
- Grid access* (>12 kVA) or 1-day operation (no need to refuel or charge)
- Strong client and policy drivers
- -10 °C to 40 °C

Preferred low carbon solutions

Battery-electric equipment

Drivers

- Zero emission policies
- Greater client demand for low carbon solutions

Operational conditions

- Power supply solutions

Operational conditions

- Remote
- Mobile
- No grid access
- Low client and policy drivers
- <-10 °C or >40 °C

Preferred low carbon solutions

HVO and Hydrogen (ICE or fuel cells)

Drivers

- Low demand for zero tailpipe emissions (client and policy drivers)

Operational conditions

- Prioritization of storable and transportable energy

 ***Note:** in addition to grid access on work sites, it is important to assess power requirements for electric equipment charging in depots

Based on the 4 equipment to be investigated and the 6 feasibility factors for a construction site to conduct an energy transition, 3 use cases (scenario) have been prioritized

Scenario	Location	Stationary vs. mobile	Duration	Grid access & power supply	Equipment	Challenges analyzed
#1 Building construction in city centers a. Before grid connection b. After grid connection ***Focus on next slide***	Urban	Stationary	1 year	12 kVA (lead time of ~2 to ~6months)	a. Before grid connection b. After grid connection	Strong pollution reduction requirements Grid connection lead time and limited power (12 kVA)
#2 Short duration public works in city centers a. <2 days b. 2 to 10 days	Urban	Mobile	1 to 10 days	No access		Strong pollution reduction requirements Energy supply logistics
#3 Remote road work	Remote	Mobile	6 to 24 months	No access		Remote location Energy supply logistics

The use cases were considered for temperatures between -10°C and 40°C

Power gen. Telehandler Mini excavator Boom lift

Enabling factors Challenges

The Total Cost of Ownership is significantly impacted by the energy transition, due to both CAPEX and OPEX changes

Low-carbon solutions bring cost structure changes

*"there is a **communication difficulty on TCO aspects** regarding the benefits of electrical solutions"*

*"**presentation of the daily rental cost including the total rental with energy** works well with customers"*

*"TCO is very critical point, solution needs to have **economical advantage at the end of the lifespan**"*

*"the **significant CAPEX of electric machines is passed on to the customer**, who does not always benefit from the OPEX gain"*

*"alternative equipment is used when **incentives and OPEX gains are superior to CAPEX**"*

*"customers are willing to pay more for low carbon technologies with **clear economical benefit**"*

An accurate TCO model will allow to precisely factor them in to…

Build profitable business cases

Conduct sensitivity analysis to key assumptions, such as

- CAPEX
- Energy OPEX
- Utilization rate
- Resale value

based on the above listed factors,

prioritize the right clients and use cases

develop your low-carbon offer at a lower risk, based on informed decisions

Advocate

To clients

- On the economic benefits beyond upfront cost (rental fee or CAPEX)

To policy makers

- Build robust fact-based arguments to support your policy advocacy
- Highlight the fossil vs. low carbon solutions cost gap

Share knowledge

With sales teams

- On cost optimization levers (e.g. utilization rate, proper battery sizing)
- On how to appropriately advise clients based on their use cases

With clients

- On how to accurately factor in cost considerations on technology choice

Data collected through interviews and/or survey

Automotive industry standards address the main issues raised on charging connectors and communication protocols in the European equipment rental market

Charging connectors: 3 main challenges

1
Harmonization issues for a given type of connector

2
Harmonization issues between connector types

3
Harmonization issues between OEMs and equipment types

Example: a 20 kWh battery machine on a grid delivering 22 kVA :

Connector type	Charging time
Type 2 mono-phase	2 hours
Type 2 three-phase	1 hour

Communication protocols

Even with harmonized plug types, interoperability may not be possible because of different communication protocols between equipment, depending on the OEM.

"Every producer is developing a machine that competitors don't have, leading to different plugs, making standardization difficult"

To standardize charging connectors and communication protocols, ERA has two options:

- **Recommended: advocate for the adoption of automotive standards** on charging connectors and communication protocols*
- Develop the industry's own standards by proposing the adoption of a European Standard (EN)

Automotive standards have been designed with the growth of the EV market and respond to the standardization needs of the European rental market

The creation of a new European Standard (EN) to respond to the market needs would trigger a lengthy process of standard creation and a dependence on standard bodies

Aligning with automotive standards will allow to use existing VE charging stations where possible

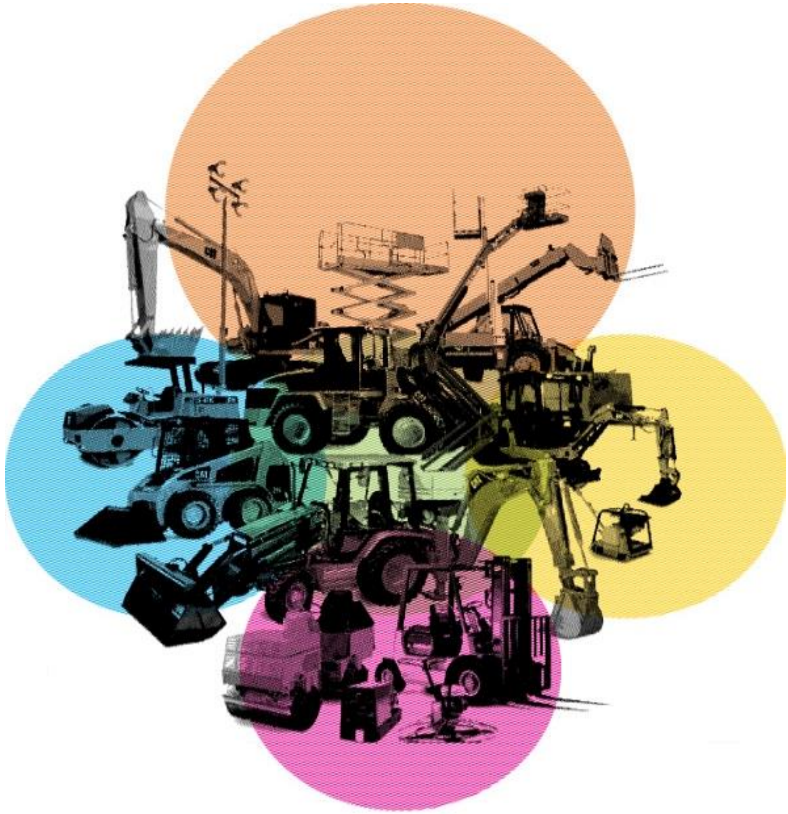
 * Although there is still a debate regarding the suitability of automotive standards for DC charging below a certain voltage (80 to 100V) | Sources: EY Analysis, OEM and rentals interviews

Glossary

Acronym	Meaning
AC	Alternative Current
ADR	Accord Dangerous Routier
AFIR	Alternative Fuel Infrastructure Regulation
B100	Biodiesel (100%)
B7	Fuel-oil and biodiesel blend (7%)
BESS	Battery Energy Storage System
BMS	Battery Management System
CAGR	Compounded Annual Growth Rate
CAN	Controller Area Network
CAPEX	Capital Expenditure
CCS	Combined Charging System
CECE	Committee for European Construction Equipment
CHAdeMO	ChArge de Move, battery standard
C2V	Cloud to Vehicle
DC	Direct Current
ERA	European Rental Association
ETD	Energy Taxation Directive
EU ETS	European Emission Trading Scheme
EV	Electric Vehicule
FIEC	European Construction Industry Federation
GHG	Greenhouse Gas
H2	Hydrogen
HC	Hydrocarbon
HQ	Headquarters

Acronym	Meaning
HVO	Hydrotreated Vegetable Oil
IC-CPD	In-Cable Control- and Protection Device
ICE	Internal Combustion Engines
IEA	International Energy Agency
LA	Lead-acid, battery chemistry
LCA	Life Cycle Analysis
LFP	Lithium Ferro Phosphate, battery chemistry
LVD	Low Voltage Directive
MCS	Megawatt Charging System, charging standard
NMC	Nickel-Manganese-Cobalt, battery chemistry
Nox	The sum of the quantities of nitrogen monoxide (NO) and nitrogen dioxide (NO_2).
NRMM	Non-Road Mobile Machinery
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
PM	Particulate Matter
R&D	Resarch and Development
RFNBO	Renewable Fuels of Non-Biological Origin
Sox	Sulfur oxides
SSEB	Subsidy for Clean and Zero Emission Construction Equipment
TCO	Total Cost of Ownership
TTW	Tank-to-Wake
V2G	Vehicle-to-Grid
V2C	Vehicle to Cloud
WACC	Weighted Average Cost of Capital
WTT	Well-to-Tank

EUROPEAN RENTAL ASSOCIATION



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