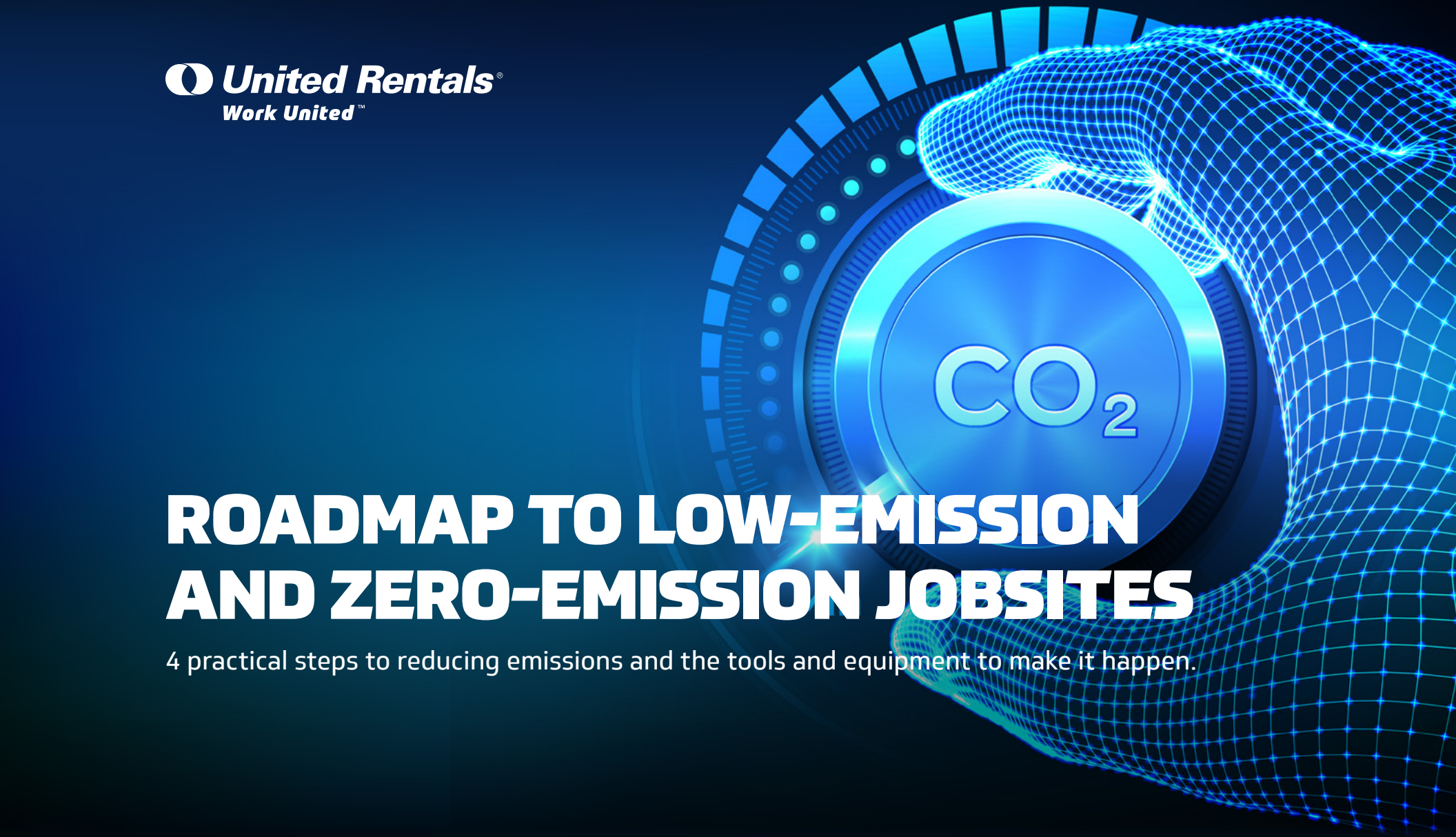
United Rentals®
Work United™



ROADMAP TO LOW-EMISSION AND ZERO-EMISSION JOBSITES

4 practical steps to reducing emissions and the tools and equipment to make it happen.

CONTENTS

INTRODUCTION

As the global focus on climate change intensifies, so does the need to embrace more sustainable construction practices. A growing number of project owners and construction companies are seeking ways to lead the charge. One critical goal is reducing greenhouse gas (GHG) emissions and other air pollutants on jobsites.

Manufacturers are beginning to offer the equipment needed to significantly reduce jobsite emissions, and zero-emission jobsites are inching closer to reality. But most construction companies struggle with where to start. In this white paper, United Rentals outlines a four-step strategic plan to shrink emissions without compromising productivity or safety.

Making jobsites more sustainable won't happen overnight. Incremental approaches, such as implementing a low- or zero-emission solution on one part of a project or identifying one category of equipment to substitute with lower-emission alternatives, can help companies reach emission targets without erasing profit margins. Renting alternatively powered equipment is an affordable way to reduce emissions without adding a capital expenditure to the balance sheet.

Efforts to reduce jobsite emissions benefit people and the planet, as well as a company's reputation and ability to win business from environmentally conscious project owners. A practical, cost-effective approach begins with data.

Manufacturers are beginning to offer the equipment needed to significantly reduce jobsite emissions.

1.

IDENTIFY THE BIGGEST OPPORTUNITIES FOR IMPROVEMENT

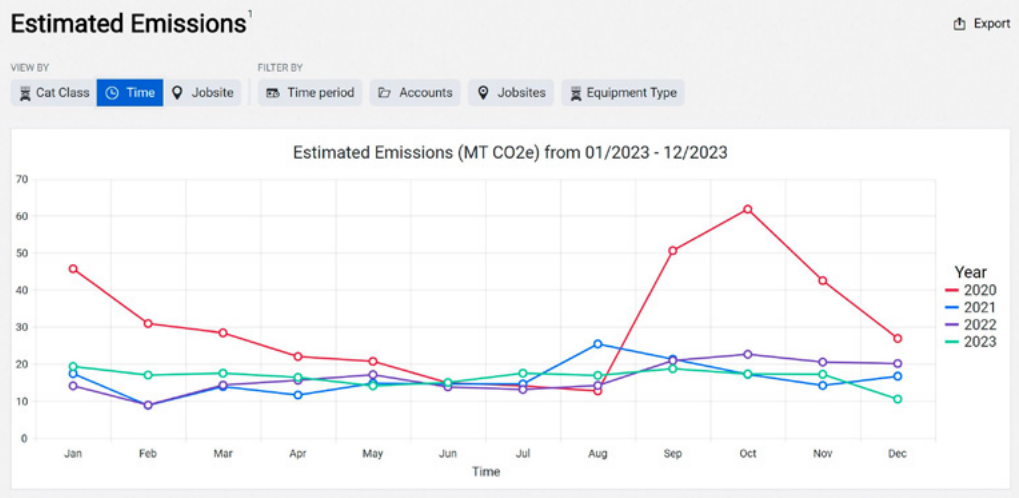
Today, replacing an entire fleet with lower-emissions alternatives simply isn't realistic. Using data to guide decisions around fleet sustainability efforts is the smart way to identify the changes that will yield the biggest return on investment.

For example, tracking the load of telematics-enabled generators can reveal generators that are oversized for the task. Tracking equipment emissions can reveal which equipment is generating the lion's share of carbon emissions. If diesel generators top the list, reducing generator run time with a battery energy storage system (BESS) or incorporating cleaner-burning generators will go a long way toward shrinking the project's carbon footprint.

Total Control® users can generate reports that drill down into the estimated GHG emissions and source pollutants of specific pieces of equipment in their rented and owned fleet. Calculations are made based on estimated fuel usage, an emissions factor specific to the fuel type used and emission certification levels.

A new tool in Total Control, the Estimated Emissions dashboard, offers a broader overview that enables higher-level strategic planning. Dynamic lists, charts and bar graphs reveal at a glance which equipment category classes and even which jobsites are top GHG emitters. Filtering by month and year provides a deeper understanding of emissions trends and allows for more targeted decision-making around how to reduce environmental impacts.

Estimating Emissions Through Total Control



Estimated Emissions by Category and Cat Class

Category	Cat Class	Estimated Emissions (MT CO2e)
Forklifts & Material Handling	FORKLIFT VARIABLE REACH 12000# 53'-69'	22.6
Forklifts & Material Handling	FORKLIFT VARIABLE REACH 8000# 40-49'	22.5
Lighting	LIGHT TOWER,4-7KW LED VERT MAST	14.5
Forklifts & Material Handling	FORKLIFT VARIABLE REACH 5000# 16-20'	10.7

Portable generators may be the biggest GHG emission producers on one jobsite, while forklifts, telehandlers or excavators might be the biggest on others. Data unlocks the power to analyze which equipment to substitute with cleaner-burning alternatives.

Once the biggest GHG producers have been identified, the next step is to identify better ways to operate using alternative equipment.

TURN DOWN THE HEAT WITH REMOTE CLIMATE CONTROL

Fuel-burning heaters are crucial to worker comfort and many drying processes, but as with generators, too often they are allowed to run continuously, which increases emissions. Remote environmental monitoring allows contractors to run heaters only as needed.

WEDGE™ from United Rentals remotely monitors temperature and humidity. Alerts notify users when thresholds are exceeded. By adding Smart Heaters to owned or rented heaters, contractors can adjust temperature settings remotely and even adjust heaters room by room or floor by floor.

2.

EMBRACE POWER GENERATION ALTERNATIVES

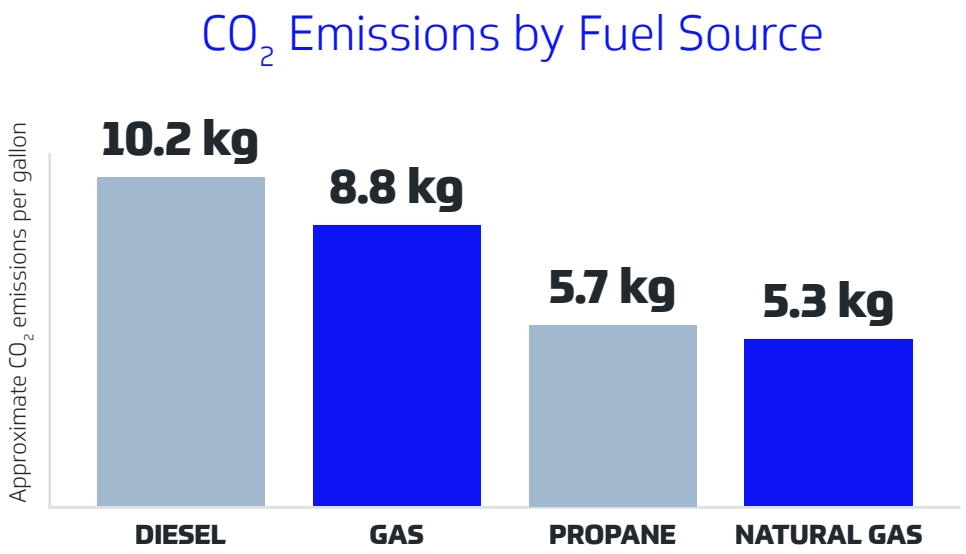
Construction doesn't happen without power. Grid power is the go-to choice for reducing Scope 1 emissions—direct emissions from burning fuel—but diesel generators typically provide the bulk of the power until a site is connected. These machines currently play a critical role in getting work done, but they also emit considerable amounts of GHGs. Corporate sustainability goals are driving some companies to seek alternatives.

A proliferation of new generation options is opening the door to a more sustainable future of jobsite power production, from cleaner-burning generators to batteries to portable solar solutions. Mixing and matching these solutions enables contractors to curb their reliance on diesel and curtail emissions without compromising operations.

PROPANE AND NATURAL GAS GENERATORS

Tier 4 generators improve on older diesel generators in terms of emissions, but generators that rely on fuels other than diesel burn cleaner still. Propane generators, for example, produce approximately 17% less GHG than diesel generators and cost up to 40% less to operate.

The JuiceBox™ mobile power generator can be powered by propane or natural gas and delivers instant power, up to 20kW, enough to charge tools and other equipment. Units can be linked together to meet higher power demands, such as electric vehicle charging.

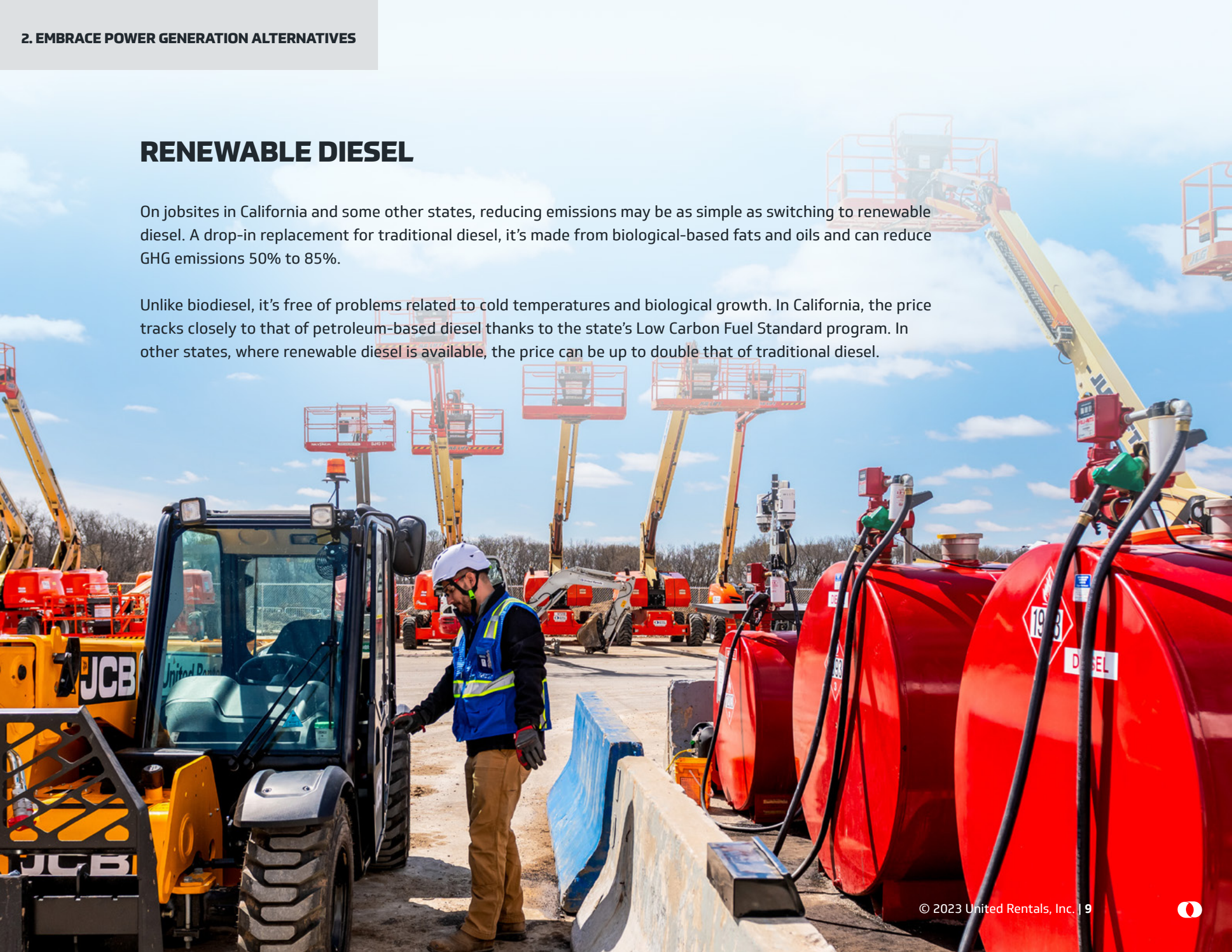


Source: EPA Center for Corporate Climate Leadership

RENEWABLE DIESEL

On jobsites in California and some other states, reducing emissions may be as simple as switching to renewable diesel. A drop-in replacement for traditional diesel, it's made from biological-based fats and oils and can reduce GHG emissions 50% to 85%.

Unlike biodiesel, it's free of problems related to cold temperatures and biological growth. In California, the price tracks closely to that of petroleum-based diesel thanks to the state's Low Carbon Fuel Standard program. In other states, where renewable diesel is available, the price can be up to double that of traditional diesel.



HYDROGEN GENERATORS

Hydrogen is poised to play an increasingly large role in the energy transition. For companies seeking to achieve zero emissions on parts of a jobsite, and for projects with strict sustainability or noise restriction requirements, a hydrogen fuel cell generator is a solution worth considering. These generators produce zero emissions and are safe to use in sensitive areas and even confined spaces.

The EODev GEH2 is one powerful, relatively compact example. It delivers an instant 110kVA of power with a footprint of less than 4 square meters (about 13 square feet). The only byproduct produced is water and heat.

Currently, hydrogen fuel cell generators make sense only in areas where hydrogen delivery is available. Storing hydrogen in bulk can simplify supply logistics and help prevent fuel-related downtime. Special hydrogen storage tanks compress and store the hydrogen at high pressure. Today, 3,000-psi tanks are relatively available. Higher-pressure tanks, up to 10,000 psi, provide more hydrogen storage in the same amount of space. Hydrogen storage regulations and permit requirements may apply.

Another hydrogen-based portable power alternative is a generator that runs on a hydrogen internal combustion engine. These generators emit a minimal amount of nitrogen oxides compared to other generators.

With the sustainability advantages of hydrogen come higher costs. The price of hydrogen is currently three to eight times as much as diesel. The monthly rental rate of a hydrogen generator is also higher—roughly three times that of a traditional generator. Still, on the right projects, these generators are beneficial.

SHADES OF HYDROGEN

Some types of hydrogen are more sustainable to produce than others. Green hydrogen, created from renewable energy, is 100% zero-emission from production to use, but it accounts for only about 5% of the hydrogen available.

GREEN HYDROGEN

- Most sustainable
- Produced from a renewable energy source such as wind by electrolyzing water

BLUE HYDROGEN

- Less sustainable
- Produced from natural gas through steam reforming with carbon capture

BROWN HYDROGEN

- Least sustainable
- Produced through coal gasification

SOLAR ENERGY

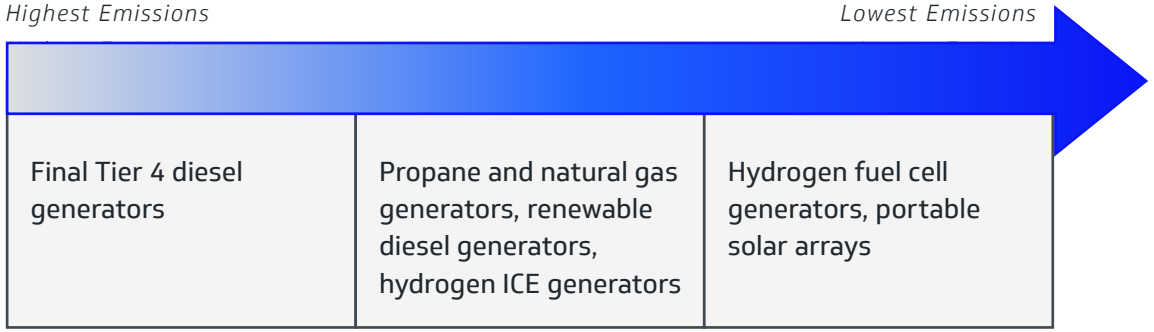
The sun provides the ultimate renewable energy source. Some equipment, such as towable solar light towers, have solar panels built in and can be used in place of equipment powered by diesel or gas. Jobsite storage containers with solar-powered lights also can eliminate the need for a generator.

When it comes to powering other electric equipment, solar generators are convenient for meeting relatively small portable power needs.

For more power, a mobile photovoltaic (PV) system such as the Termaco Reserve Electrical Energy Power 10, which features folding solar panels, is a zero-emission solution that can power all the tools on a jobsite as well as office trailers. PVs can be combined with a battery to create a zero-emission hybrid power generation solution. Read more about hybrid power systems in the next chapter.

Power Generation: Good, Better, Best

Manufacturers are offering more and more alternatives to traditionally fueled generators for onsite power generation. Newer equipment options are typically more expensive, but costs will decrease as the technology ages and alternative fuels become more widely available.



3.

LEVERAGE BATTERY ENERGY STORAGE

Energy storage is revolutionizing the construction landscape by allowing companies to reduce their use of emission-generating portable power equipment. Bigger and better stand-alone batteries have the power to replace some diesel generators, and hybrid power systems that use a battery to store excess power can slash generator run time and thereby fuel use and emissions.
As energy storage options become more available, cost effective and convenient, they will play an increasingly large role in reducing GHG emissions.

STAND-ALONE BATTERIES

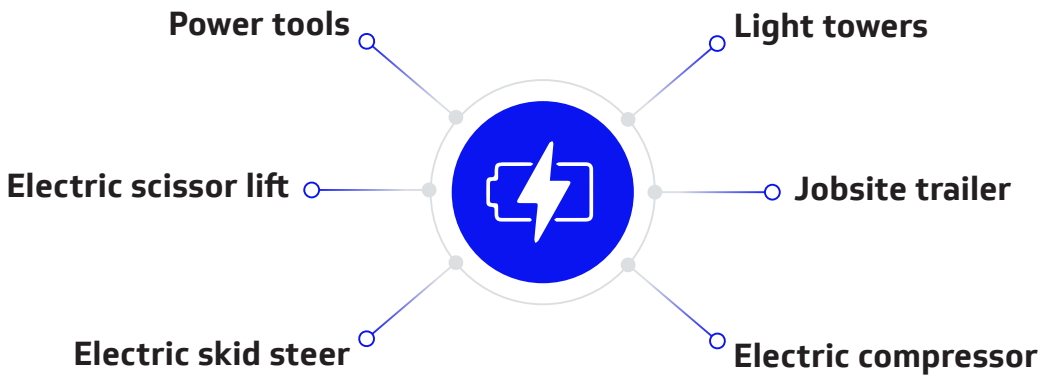
Advances in battery technology have allowed manufacturers to offer larger, faster-charging stand-alone batteries with enough kilowatts to power or recharge most electric tools and equipment on a jobsite, as well as office trailers. Some can be connected to an additional power source such as a generator, but most typically aren't. Large units can be towed or trailered to the jobsite.

The batteries can be charged by a Level 2 AC charger or, for faster charging, a Level 3 DC charger. With some large battery solutions, the battery packs can be swapped by the rental provider for fresh ones when the stored energy runs low.

For companies seeking to embrace more sustainable portable power options, batteries offer quiet power and zero emissions at the source. Different sizes are available to fit different power needs. The Moxion MP-75, for example, offers 75 kW of power at 480 volts, with an impressive 600 kilowatt hour (kWh) rating.

What Can a Battery Power?

Depending on the size, a battery can charge some or even most of the equipment on a jobsite. Stand-alone batteries come as large as 500 kW.



BATTERY ENERGY STORAGE SYSTEMS (BESS)

Pairing a generator with a BESS creates a hybrid power solution that dramatically curtails generator run time, fuel consumption and emissions and optimizes power production by the genset. Composed of high-density lithium batteries, inverters and load-sensing technology, a BESS is charged by the generator when it runs, or by a renewable power source such as a solar array. During lower-load periods, the BESS provides the power on its own.

One example is the POWRBANK from POWR2. Rated for 40kW to 60kW of output, it offers enough power to power a guard shack overnight.

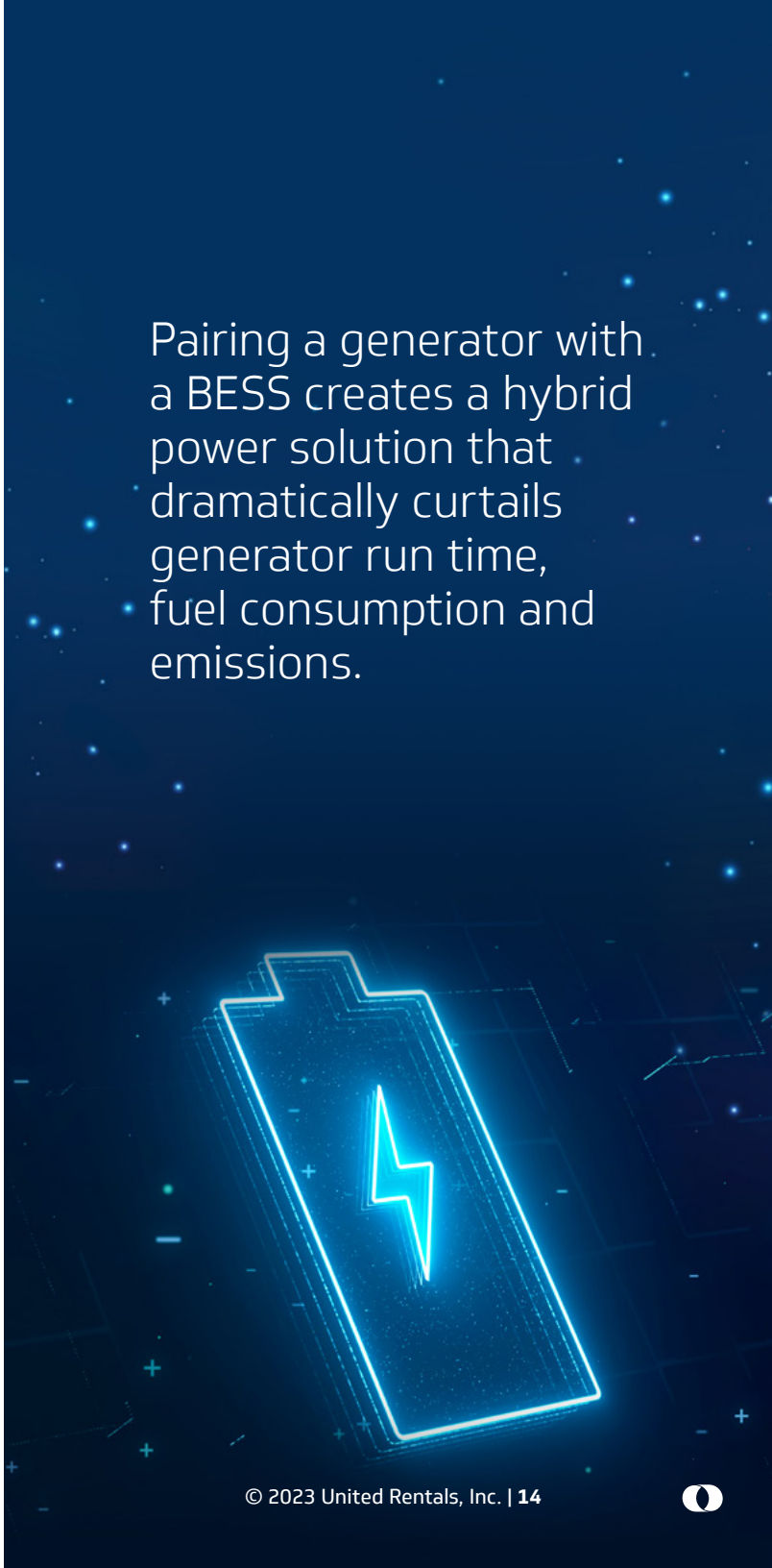
The towable ANA Energy Boss™ provides all-in-one continuous power, with the BESS, diesel generator and control systems housed in one unit. It features ultra-high life cycle battery technology for extended cycle life. Built-in telematics enables remote monitoring.

The emissions savings from a hybrid power solution depend on power source used. Adding a BESS such as the POWRBANK to a diesel generator can reduce emissions by up to 80%. Leveraging a propane or gas generator results in even lower emissions. A hydrogen generator or solar array plus battery energy storage yields a zero-emission solution.

SELF-CONTAINED MICROGRIDS

Some hybrid power solutions provide enough power to act as self-contained, low-emission microgrids. The HIPOWER® EHR Solar Battery Generator, developed in conjunction with United Rentals, is a BESS that features an integrated 10kW solar array atop the unit and an integrated 50kVA propane generator. Mounted on a trailer or skid, it provides enough juice to power container offices and restroom trailers and charge aerial lifts, lights and power tools.

Pairing a generator with a BESS creates a hybrid power solution that dramatically curtails generator run time, fuel consumption and emissions.



4.

INCORPORATE ELECTRIC OR HYBRID EQUIPMENT

Another cornerstone of the cleaner, quieter construction site of the future is electric equipment. Impressive strides in rechargeable battery technology have allowed manufacturers to push beyond small electric units such as warehouse forklifts and scissor lifts to larger, heavier equipment categories such as mini excavators and compact telehandlers capable of lifting 5,250 pounds.

Electric equipment offers performance on par with that of traditionally fueled counterparts while eliminating direct emissions. The higher upfront expense is partially offset by lower operating costs and significantly reduced maintenance needs. Lithium-ion batteries and electric engines are essentially maintenance free.

Renting electric equipment is a smart way to test it out before committing to a capital expenditure. It provides a chance to see how the equipment performs on different tasks and experiment with charging options and charging schedules. If the equipment is a good fit, renting may still be the most cost-effective choice, depending on utilization.

PLAN FOR ON-GRID CHARGING

When using the grid to charge equipment, a 240-volt Level 2 AC setup is often recommended. It's possible to charge equipment with a standard 120-volt outlet, but charging will take anywhere from twice as long to four times as long. A level 3 DC charger is the fastest option, charging equipment in half the time or less compared with a Level 2 charger. That said, slower (Level 2) charging may extend the battery life of the equipment.

Consider future charging needs as well as current needs when investing in charging infrastructure.

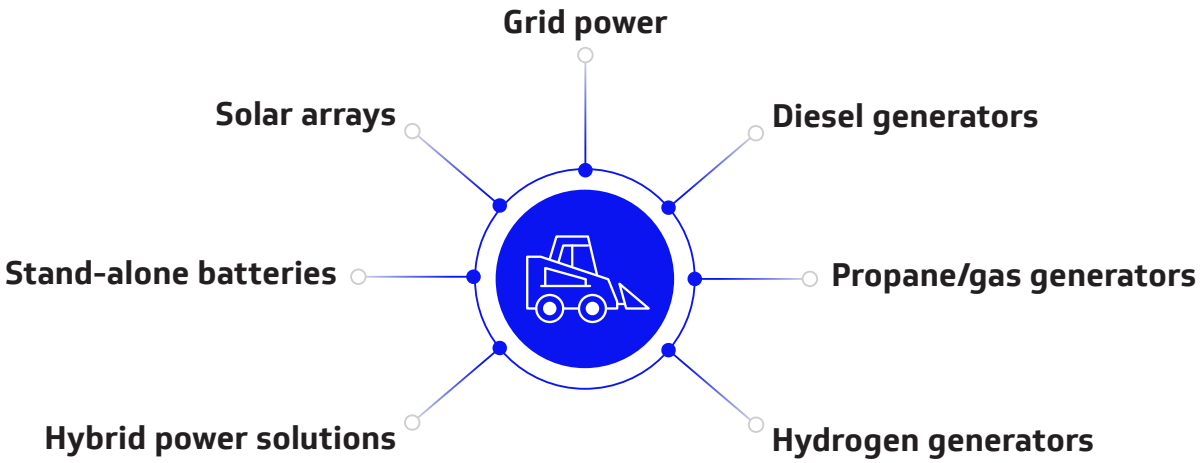
HYBRID EQUIPMENT

For contractors who want the power of a large diesel machine with lower emissions and the ability to operate indoors, hybrid equipment is a valuable option. It combines battery electric technology with an internal combustion engine (ICE). The battery can provide power on its own or provide additional power during periods of high demand.

Hybrid equipment such as hybrid boom lifts and mini crawler cranes can serve as direct replacements for traditionally fueled equipment. Fueling logistics don't have to change, since the equipment uses traditional fuels. While hybrid equipment can cost up to twice as much as traditional models, some of the premium is offset by fuel savings and reductions in maintenance needs.

Charging Options for Electric Equipment

Companies should consider all the power needs of a jobsite when choosing power generation equipment to help ensure uninterrupted operations.



CONCLUSION

For contractors with large or small budgets, reducing construction site emissions is possible now. A smart strategy starts with data. Targeting the predominant sources of emissions on projects and jobsites allows sustainability managers to focus their efforts, and dollars, on changes that will yield the biggest results.

Renting provides an opportunity to experiment with more-sustainable solutions—such as new portable power options, battery energy storage systems and electric machines—without investing in new equipment. All of these technologies can work together to reduce the reliance on traditional fuel and help companies begin the shift to lower-emission and even zero-emission fleets.

Change happens slowly at first, then gains momentum. Today, many larger construction companies are leading the charge to embrace more sustainable equipment and ways of working that create cleaner jobsites. Tomorrow, some of these approaches will be standard operating procedure. In the meantime, companies of any size can take small, successive steps to increase the sustainability of their operations while preserving productivity and profits.