



FOUR QUESTIONS WHEN CONSIDERING AN ELECTRIC FUTURE FOR YOUR PORT EQUIPMENT

With fossil fuel volatility and a growing global focus on sustainability, the port and terminal industry faces significant pressure to pursue decarbonization. The electrification of container handling equipment at ports is in its infancy, but the landscape is evolving relatively quickly. Governments and companies are setting timelines for reducing emissions, and C-suite terminal executives with technology and sustainability responsibilities are considering the kinds of solutions that will be necessary to achieve those goals while satisfying the performance requirements of their operations. As you prepare for the future of clean power at your port, here are a few common questions to explore.

1

WHERE IS THE INDUSTRY IN THE SHIFT TO ZERO-EMISSION EQUIPMENT AT PORTS?

The port industry is in the early adopter phases, with product development and pilots underway. Two major forces are the primary drivers for port operations increasingly evaluating and moving toward adoption of electric-powered equipment:

- Government action in the form of regulations and incentives
- Corporate sustainability initiatives

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Within the United States, the [California Air Resources Board \(CARB\)](#) is a leading driver of port decarbonization policy. Initially established to evaluate pathways for transitioning cargo handling equipment to zero-emission technologies, statewide zero-emission cargo handling equipment requirements proposed by CARB in 2018 have not yet been adopted. However, CARB is still actively assessing technology availability, operational feasibility and infrastructure readiness through its Cargo Handling Equipment Technology Assessment, which is expected to inform future regulatory actions. At the federal level, the [U.S. Environmental Protection Agency's Clean Ports Program](#) — part of the Inflation Reduction Act of 2022 — has entered its implementation phase, having awarded nearly \$3 billion in grants to 53 projects supporting zero-emission port equipment, charging and fueling infrastructure, shore power, and climate and air quality planning at ports across the United States. In parallel, sustainability commitments from major shipping lines, terminal operators and logistics companies continue to drive investment in port electrification, helping ports reduce emissions while improving operational efficiency and community air quality.

It takes time for manufacturers to demonstrate viable electric trucks for these applications can be produced in volume at an attractive price point, but there are promising pilots in planning and in progress. For example, in Germany, Hamburger Hafen und Logistik AG (HHLA) is deploying an [HFC-powered empty container handler and terminal tractor](#) at HHLA Container Terminal Tollerort (CTT), alongside plans for future integration with the local hydrogen network. And a battery electric empty container handler powered entirely by 650-volt lithium-ion batteries is currently being piloted by [Malta Freeport Terminals](#). While there is currently a significant cost differential between container handling equipment fueled with diesel and alternatives powered by electric motors, as more electric-powered equipment enters the market, economies of scale will help drive parity. A discovery of what may be the [largest concentration of lithium in the world](#) could also significantly change the global supply and cost dynamics of this key chemical element used in lithium-ion batteries.

A typical container handler has a lifespan of about 10 years in a port setting, so if CARB's 2036 target becomes a mandate, operations in that state will still have an equipment lifecycle or two before needing to shift. Although deadlines aren't imminent, the current moment is an important time for ports to do research and understand the options, because a smooth shift to electric equipment involves significant preparation. Determining and implementing the right solution for each operation requires careful evaluation of power choices, charging or refueling equipment, along with utility grid changes or the production and transportation of hydrogen fuel.



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2

HOW CAN I START TO GET A BETTER UNDERSTANDING OF HOW CLEAN POWER CHOICES MIGHT WORK AT MY PORT?

Take this opportunity to gather information about the development and prospects of various power technologies and to test and iterate at a small scale before pursuing the adoption of entire electric fleets. For instance, terminals can pilot a single electric container handler or trial electric alternatives for some of their lower-capacity equipment before transitioning additional units. While most container terminals typically rely on only five heavy-duty forklifts for every 40 or so container handlers, this equipment can be a good starting point. That is because in some cases, electrification of this forklift equipment is more mature relative to container handling equipment with much higher capacities. In fact, more than one hundred large forklifts are already authorized for rebates in the CARB [Clean Off-Road Equipment \(CORE\) catalog](#), including forklifts with load capacities of 15,500- to 19,000-pounds (7,000- to 9,000-kilograms) and even ones in the 23,000- to 36,000-pound (10,000- to 16,000-kilogram) range.

Supplying electric power, whether from the grid or hydrogen, is a responsibility that port authorities must anticipate, not only for the demands of a single truck but multiple units or even a full fleet. Neither electricity nor hydrogen are primary fuels, so understanding the complete carbon impact requires looking at the feedstocks from which they are produced. As of early 2025, just over 34% of energy generated globally was from renewable sources like wind, hydro, solar, biomass and geothermal – overtaking coal for the first time. The share of green hydrogen is lower, representing less than 1% of hydrogen production worldwide. In addition, the broader hydrogen ecosystem – including production, distribution and fueling infrastructure – is still developing, which can impact both accessibility and cost. However, ongoing investment and development in clean hydrogen production have the potential to improve both the carbon profile and availability of this energy source over time.



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3

WILL ELECTRIC STAND UP TO THE RUN TIMES OF OUR WORKDAYS?

Zero-emission options are being designed to provide enough capacity to keep operations moving and avoid the need to stop in the middle of a shift to recharge, or in the case of hydrogen fuel cells, refuel. But the required time and frequency of recharging or refueling are very important considerations and highly variable based on the application requirements. An operation's duty cycle, the charging strategy, battery size, charger size and charge rate of the truck all influence how quickly a battery electric solution can be recharged and how long it can operate between charges. Powering equipment with HFCs can mitigate many of the questions or concerns about the ability of electric alternatives to stand up to demanding run times, as operators refuel a tank of hydrogen similar to the process for refueling with diesel. For large equipment like

container handlers, it can take as little as 15 minutes to fill the empty tanks with hydrogen – providing enough energy for up to 10 hours of continuous run time. And while green hydrogen is not yet universally available, there is a growing number of locations where the access to this energy source makes it a very viable solution.

While recharging batteries and refueling with hydrogen pose a new set of challenges compared to internal combustion engines (ICE), electric drivetrains have fewer moving parts and less complexity, which can reduce the downtime required for maintenance. With electric equipment, batteries and certain wearable components, like switches, require replacement over time. But many time-consuming maintenance tasks are eliminated, such as taking the head off a diesel engine and rebuilding it every 15,000 hours or so.



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4

DO I HAVE THE NECESSARY EXPERTISE AND SUPPORT FROM A LOCAL DEALER TO NAVIGATE THE SHIFT?

As with other material handling equipment decisions, a strong relationship with a supportive dealer is very important. Working with the manufacturer, a dealer should have the experience and expertise to help you assess various power technologies and provide a solution that helps meet your goals for emissions reduction and performance. Because dealers not only sell critical equipment but provide training, parts and service, it is important to verify that the dealer you choose to work with is well-capitalized and trained. While the operator controls for electric equipment are intentionally similar to those of diesel equipment, operators need to be trained on best practices for recharging or refueling electric forklifts or container handlers.

Not all electric equipment is high-voltage, but electric equipment that is high-voltage also requires special technician training and certification to adhere to safety standards and prevent electrical danger or injury when performing maintenance. Many terminals have high-voltage electric ship-to-shore cranes already, but technicians who are certified to service that equipment may not have the product training that is required for high-voltage forklifts or container handlers. When equipment needs service, the resources and staffing of your dealer can be the difference between a rapid response or waiting three weeks for a necessary part or technician availability. As your terminal looks toward adopting electric equipment in the future, prioritize the maintenance support of skilled technicians or training support for your in-house technicians.

For more information on electrifying your fleet, talk to your local Hyster® dealer or [contact an electrification expert](#).