



## HYDROGEN FUEL CELLS POWER ROUND-THE-CLOCK MANUFACTURING PRODUCTIVITY

**F**rom automotive and aerospace to textiles, filtration systems and more, manufacturing depends on maximizing efficiency at every level to succeed in a competitive global marketplace. With profit margins often less than 10 cents on each dollar of revenue, the just-in-time system reflects the industry's extreme cost consciousness. Processes are carefully tuned to maximize output while minimizing waste in the face of space constraints, labor challenges and cost pressures. Materials arrive on-site just before manufacturing commences, enabling production operations to stay lean and squeeze maximum output out of available space, but leaving little slack time and margin for error.

This lean philosophy extends to material handling equipment. Manufacturers depend on lift truck fleets to power a variety of processes, from loading and unloading on the dock to keeping components flowing to assembly lines. How can they minimize material handling costs without compromising performance? A common place to look for potential improvements is in the warehouse. This may mean upgrading to more efficient equipment, adding more advanced warehouse management systems and hiring more workers.

This piece covers a hypothetical scenario that illustrates how more efficient technology, specifically changing the power source on electric lift trucks, can enable a manufacturer to unlock greater productivity at lower cost – just what lean production operations need.



### // PACKAGING EQUIPMENT MANUFACTURER

Like many American manufacturers, this example of a packaging equipment manufacturer that operates several locations across the country, each dedicated to producing different products for various industries, from injection molding equipment to bottling and sealing systems. For an assembly plant as large as 850,000 square feet running three shifts, seven days a week, a fleet of 100 lead-acid battery-powered lift trucks would be appropriate, including:

- Pallet trucks and four-wheel sit-down trucks for loading, unloading and other dock work
- Order picker and narrow aisle trucks to retrieve components from high, dense storage locations
- Tow tractors to gather and transport components to assembly lines



### // UNACCEPTABLE DOWNTIME

Equipment downtime is completely contrary to the lean principles of finely tuned manufacturing operations, but regular lift truck downtime can cost operators precious productivity. The cause? Lengthy lead-acid battery charging procedures.

Halfway through a shift, many of lift trucks begin to experience lower drive and lift speeds due to battery power degradation. That signals operators to take their trucks to the battery storage area for a swap. Driving to that area, swapping a lead-acid battery and getting back to work can cost operators about 20 minutes, or even longer if they must wait while other trucks are swapping batteries.

But that's not all.

To charge lead-acid lift truck batteries, the facility depends on the local utility service. Problem is, occasional brownouts in the area can prevent batteries from charging, risking trucks and operators sitting idle. And during peak electricity demand, charging lift trucks can be subject to higher rates.

The Hyster Emerging Technology team can evaluate such a scenario and recommend a best-fit power solution, evaluating volatile organic compounds in the air, truck age, lease terminations, attachments, duty cycle, number of shifts, number of batteries and kilowatt-hour (kWh) rates. In this scenario, based on data from the application survey, hydrogen fuel cells emerged as the best solution to address challenges related to downtime and ongoing charging costs.



### // FUEL CELL SOLUTION

Lift truck operators can refuel hydrogen fuel cells in three to five minutes, enabling them to get back to work quickly – roughly 15 minutes faster than the 20 minutes required to change a lead-acid battery. No power degradation means lift trucks operate at full power until depletion, just like an internal combustion engine. Plus, fuel cells fit easily into the standard battery box of existing trucks – a simple retrofit.

Since lift trucks powered by hydrogen fuel cells have minimal downtime due to refueling, idle time is at a minimum and with the trucks ready and fueled, other operators can use them during breaks. With components to retrieve and assembly lines to keep moving under the shadow of tight margins, high truck utilization is essential.

While fuel cells do not come with the daily maintenance requirements of lead-acid batteries, they do require a limited amount of periodic maintenance, typically about two to three times per year. The same lift truck dealer that performs regular truck maintenance may also service the fuel cells, enabling both types of service to be scheduled simultaneously for minimal operational disruption.



*LIFT TRUCK OPERATORS CAN REFUEL HYDROGEN FUEL CELLS IN 3 TO 5 MINUTES, ENABLING THEM TO GET BACK TO WORK QUICKLY*



### // WHAT COULD YOU DO WITH MORE SPACE?

Lead-acid batteries need a full 8 hours to charge and 8 hours to cool down before they can be used again, so manufacturers can allocate two or three batteries for each lift truck to avoid productivity losses. What's more, maintaining and storing so many batteries requires a significant amount of space – a designated area of 5,000 square-feet.

By contrast, switching to fuel cells includes installing four hydrogen dispensers throughout the facility for convenient refueling, each the size of a standard gasoline pump. To figure out the best option to source hydrogen fuel, manufacturers can rely on the Hyster Emerging Technology team to guide them through available options and help make the best decision for their operation. For example, rather than generating hydrogen on-site or getting it delivered as liquid, the Hyster team can recommend the option with the least amount of on-site infrastructure – hydrogen gas delivered in a trailer and parked outside the facility. The trailer includes telemetry so that operations can monitor supply and schedule deliveries to keep hydrogen flowing to indoor dispensers. These dispensers are located throughout the facility for convenient refueling and consistent lift truck power without the burden of managing and maintaining a massive fleet of lead-acid batteries.

Switching the entire fleet to fuel cells can completely eliminate the large battery charging and storage area, opening up space for profit-generating activity and expanded output – increasing revenue per square foot without adding on to the building.

### // SUPPORT SUSTAINABILITY INITIATIVES

With hydrogen fuel cells, facilities are no longer on the hook for costs to replace, maintain and dispose of lead-acid batteries. Plus, sustainability benefits help support compliance with tough emissions regulations, take advantage of tax credits and strengthen corporate green initiatives. Not only does hydrogen produce zero harmful emissions, it avoids the environmental impact associated with disposing of lead-acid batteries.

Based on a potential hydrogen consumption of 300 kWh per day, the Hyster Emerging Technology team would recommend liquid hydrogen deliveries because of a lower price per unit. After a moderate capital expenditure for a hydrogen storage tank and conversion system, the facility would only pay for liquid hydrogen delivered regularly via tanker truck, which is less expensive than hydrogen gas delivery.

### // IMPACT

Switching from lead-acid batteries to hydrogen fuel cells can help keep lift trucks running longer, increase throughput and open up floor space to keep up with demand – without running up excess costs on extra batteries, additional equipment or construction. With proven results at a single facility, manufacturers can roll out hydrogen fuel cells to other sites across their network.

To learn more, visit [Hyster.com](https://www.hyster.com).