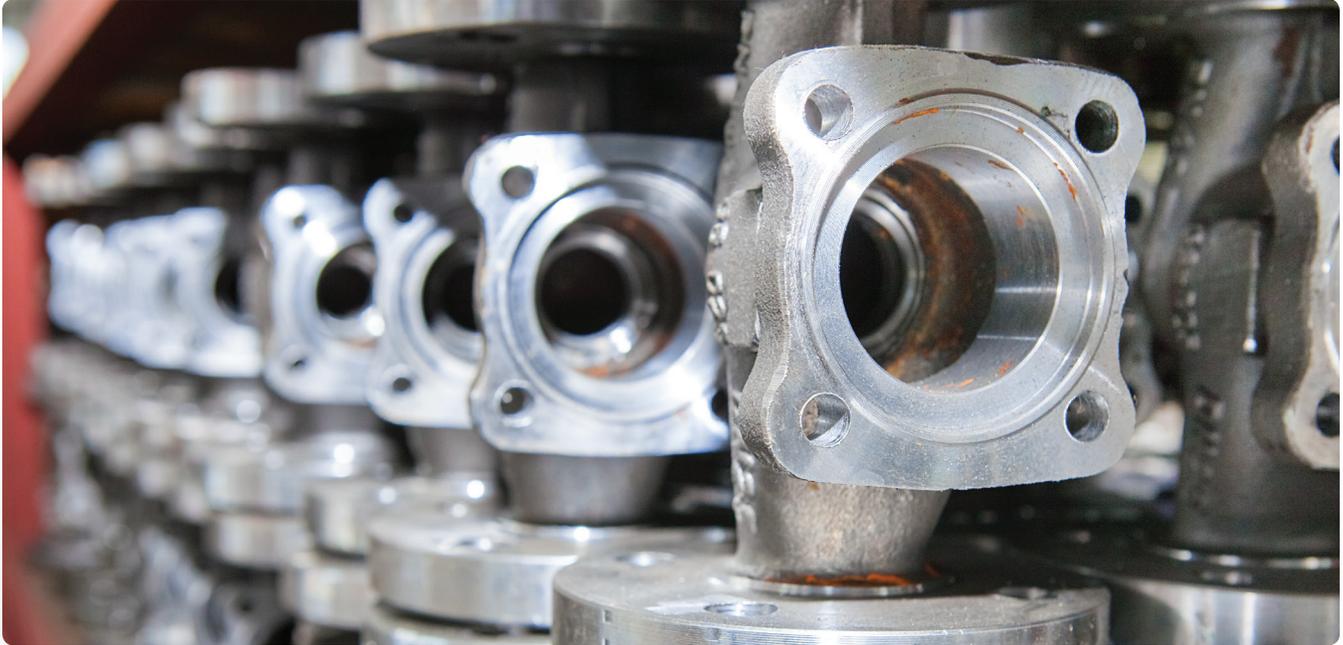


## Fuel cells help reduce issues with battery charging and lowered productivity



### Background:

In early 2016, a customer in the automotive industry had a fleet of 16 Yale<sup>®</sup> Class 1 lift trucks to support their material handling operations. These operations include three shifts per day and total more than 3,000 hours annually in a 565,000 square foot facility. To power these trucks, the customer had been using lead acid batteries with 'fast charging' methods to keep them running.

### Challenge:

As demanding workloads increased, powering the trucks became a challenge due to charging limitations with lead acid batteries. The customer utilized opportunity charging, or fast charging, during operator breaks throughout the shift. Unfortunately, they were never able to keep the lead acid batteries at the desired charging levels, and this led to a decrease in overall productivity. With fast charging, it's ideal to have batteries charged between 40 to 80% full, but the customer was allowing their batteries to go down to 25%. During a break, they provided a 10-minute fast

charge back up to 40%. Unfortunately they were never able to get the battery charge where it needed to be for optimal performance.

With these poor charging habits, they were also damaging the batteries which led to them having a shorter shelf life. This is a common occurrence with fast or opportunity charging as every time a charge is made, either for 10 minutes or 8 hours, this counts as a cycle and there are a limited amount of charging cycles in the life of this battery. This charging method caused the customer to replace the batteries much sooner than originally planned.

**“Every time I walked into their facility, I'd see four operators sitting on their trucks while they were charging. They were losing valuable uptime to charge batteries.”**

*-Yale Dealer*

In an effort to always have fully powered trucks, the customer rented additional lift trucks to aid them with their workload. This allowed the customer to charge the additional trucks during their shifts and to swap trucks whenever a charge was needed. This costly measure was deemed necessary to ensure they maintained operator productivity, but increased the overall cost of operations.

### Solution:

As the customer's fleet of lift trucks was ending its leasing terms, a Yale dealer met with the customer to discuss new lease options. During this site visit, the customer discussed pain points with the lead acid batteries and the ineffective charging habits. They discussed adding a battery swapping station so the trucks would always have a fully charged battery. However, this solution would require the customer to have multiple batteries per truck on hand, an 80-foot charging station wall and added infrastructure. For an automotive tier one parts supplier, space is a premium, so this solution created more problems due to space limitations.

With lead acid batteries no longer meeting the needs of the customer, the discussion turned to Nuvera hydrogen fuel cells. Using hydrogen as a fuel source would eliminate battery charging headaches because refueling can be completed as quickly as 3 minutes. The fuel cells allow for higher productivity and save space by replacing the multiple charging stations with a single refueling station.



### “...lead acid batteries are no longer meeting the needs of the customer.”

-Yale Dealer

Although the company liked the fuel cell idea, it wasn't prepared to invest the capital expense of building an onsite hydrogen generator and infrastructure. To alleviate this issue, the dealer brought in a delivered hydrogen solution. The hydrogen was delivered in a trailer which connects to a much simpler infrastructure consisting of piping that leads into the facility and connected to a single dispenser. In this situation, the customer would have very little up-front costs, and a new hydrogen trailer would be delivered to their site. This hydrogen delivery system was very appealing to the customer, and ultimately made them decide to move forward with the Nuvera hydrogen fuel cells.

### Impact:

The customer's whole fleet is now running on hydrogen fuel cells and they remain very satisfied. Operators are able to maintain better productivity throughout their shifts and complete refills as quickly as 3 minutes. They have also reclaimed their warehouse space with the removal of the battery charging stations. With their Yale® trucks now running at 100% capacity with minimal downtime, the customer no longer needs as many trucks as they previously did while using lead acid batteries. The fleet size decreased from 16 lift trucks (plus rental trucks) to 14 lift trucks. The company no longer needed multiple batteries per truck and is now on a one-to-one truck to fuel cell ratio. With the reduction of fleet size and batteries, the customer was able to offset the cost of the advanced fuel cell solution.

The dealer has maintained a strong relationship with the customer and continues to support their hydrogen needs. And after six-months of usage, the customer couldn't be happier with their decision to change from lead acid batteries to hydrogen fuel cells.