



# Fuels for thought

For years, there have been trials of forklift trucks powered by hydrogen fuel cells. Cleaner and greener, yes – but will they be seen in UK plants any time soon? Laura Cork finds out

Concerns about the supply infrastructure for hydrogen fuel cells and questions about the safety of refuelling saw the early surge of fuel cell-powered forklift trials slow to a trickle. That's no longer the case and trials, particularly in the US, have now given way to real-life applications.

In February this year, Coca-Cola unveiled a 37-strong fleet of forklifts powered by hydrogen fuel cells at a bottling plant in San Leandro, California. The trucks feature GenDrive fuel cells, developed by US-based Plug Power, which can be refuelled in minutes and are designed to replace the traditional lead-acid batteries. The contract was one of the first under a joint venture for Plug Power and French partner Air Liquide for provision of the hydrogen fuel cells. The drinks manufacturer says its new fuel technology is increasing productivity by 15%.

Meanwhile, in May Procter & Gamble announced that it is converting forklift fleets at three of its US factories to hydrogen fuel cells. Here, too, Plug Power is supplying the technology. But while these trucks may be greener, for P&G this is about much more than a nod to sustainability. Vice president Stefano Zenezini describes fuel cell forklifts as "a financially attractive proposition", thanks to the productivity boost they deliver. "Our analysis shows that we can not only achieve sustainability benefits, but also an attractive rate of return," he adds.

Once the conversion process is complete, more than 200 fuel cell forklifts will operate across the three P&G sites. P&G says the trucks sustain power for an entire shift and are much faster to refuel – taking about two minutes with hydrogen gas.

However, while the US may have led the charge, significant strides are being taken much closer to home, too. A six-week trial of fuel cell materials handling equipment took place during February and March this year at Marks and Spencer's new Prologis Park distribution centre in Bradford. And while the project played out in a retail distribution centre, plant users should also take notice.

## On-site instant hydrogen

The first trial of its kind in the UK, it saw powered pallet trucks and a reach truck using hydrogen generated on site to refuel the equipment, which was used over a 24-hour shift pattern. The company behind the technology – Sheffield-based ITM Power – deployed its HFuel transportable hydrogen refuelling station to the site. It looks like a freight container, but is anything but. A self-contained module, it generates hydrogen by electrolysis, compresses the gas, stores it and dispenses it at high pressure (350 bar). Once in position, all it needs is a water supply and electrical power.

During the trial, 60kg hydrogen was generated

and dispensed via 150 refuels, with the trucks running for 12–18 hours between refills. Darrell Stein, M&S logistics director, says data will now be analysed and compared to electric-powered trucks, in terms of performance, space requirements (for battery charging rooms), and the health and safety.

What do the forklift suppliers say? Briggs Equipment, distributor of Yale forklift trucks, is a firm believer in hydrogen fuel cells. Technical manager Trevor Clifton says the M&S trial may yet be seen as a turning point. “The results have been so positive, with reports of reliability, long life and high levels of productivity, that it is clear fuel cell technology will have a major role to play.”

## Electrics and hybrids

But as well as fuel cells, alternatives include hybrid trucks and lithium ion batteries. Truck manufacturer Toyota Material Handling Europe stated last year that it is taking a ‘portfolio’ approach to fuel technology. “There are three technologies that we are currently developing and trialling across the globe: hybrid engine and battery technology in Japan; hydrogen fuel cell technology in the US; and lithium ion battery technology in the UK and across Europe,” explains

Tony Wallis, UK operations director.

Commenting on the hybrid forklift, which, as yet, is only available in Japan, he says: “The challenge with internal combustion engines

is to cut fuel consumption – which, in turn, will result in lower running costs, less fossil fuel usage, and reduced exhaust and CO<sub>2</sub> emissions. Our trials in Japan show that fuel consumption in this hybrid is halved, compared to IC trucks.”

Electric forklifts provide a different challenge, in terms of battery recharging, which takes from six to 12 hours. “Hydrogen fuel cell technology has the potential to address the constraints of both IC engine trucks and electric trucks by providing a productive truck, refuelling in a matter of minutes for continuous use and with no CO<sub>2</sub> exhaust emissions,” asserts Wallis. “Yet, to become a mainstream fuel in the future, producing sufficient quantities of hydrogen in a cost-effective way, with low environmental impact, is the challenge.”

For Toyota truck users in the UK, there could be a long wait for fuel cells or hybrids, so the swiftest improvement may come from lithium ion batteries. Indeed, Wallis believes this is likely to have “the greatest impact on businesses in the UK and Europe”. Last September, Toyota announced a trial with Sainsbury’s that is currently ongoing, with equipment including heavy-duty powered pallet trucks and order pickers. These trucks are often required to work multiple shifts, so battery efficiency and charging are priorities. “The trials are going very

well and the commercial and environmental impacts are now being evaluated,” says Wallis.

Elsewhere, German truck manufacturer Jungheinrich has nailed its colours to the lithium ion mast. The company was the first to offer a lithium ion unit, when it launched a powered pallet truck last year. After trials with Tesco, its EJE 112i is now on the market. Charging is fast: it takes 30 minutes to deliver a 50% charge and a full charge takes 80 minutes.

Linde is also keen on lithium ion. Product manager Jana Vitkova says the manufacturer has already developed prototypes. “We recognise [lithium ion technology] as being a possible future market requirement and will work with customers to understand how this suits their needs.”

As for hybrid trucks, her position is clear. Vitkova says Linde sees “no viable economic benefit for our customers,” adding that advances with IC trucks – making them quieter and more fuel-efficient – deliver the best bet for the foreseeable future.

However, the firm put two fuel cell forklifts into a Linde Gas plant two years ago: the technology for the three-tonne capacity forklifts was developed with Hydrogenics, a Canadian fuel cell manufacturer. In place of the usual 80V battery, these forklifts have a fuel cell and a tank that stores 1.6kg of hydrogen gas at 350 bar. The trucks are used for 1,000 hours per year and, says Linde, another 15 similar warehouse trucks will soon follow. “Demand is still limited, due to the high costs of fuel cells and filling stations,” comments Vitkova.

That said, it is interesting (given its same ownership) that truck manufacturer Still takes a very different view of hybrid technology. Still launched its RX70 hybrid truck – based on the RX70 diesel version – at German materials handling exhibition CeMAT last year. It features high performance, double layer capacitors mounted at the rear. These are charged as the truck brakes. Energy collected is consumed by a generator, additionally driven by the diesel engine, to power the electric drive motor. Still says its capacitors reduce the load on the diesel engine by 30%.

Potato and vegetable business Branston is using nine of Still’s hybrid trucks at its prepared foods factory near Lincoln. Andy Peacock, logistics and supply manager, says: “The leases on our forklifts were coming to an end and we ... wanted something that was not only more cost efficient, but also more environmentally friendly. The RX70 ... has already won an award for its environmental benefits and this is very important to us.” 



**Hydrogen fuel cell, Li-ion and hybrid forklifts are entering the mainstream**

