

**SPECIAL REPORT** BY NICK GIBBS

# Could battery swapping solve infrastructure woes?

THE TOPIC OF EV battery-swapping will be hotly debated across Europe in the next few years. We believe the technology offers a practical solution with, crucially, the strong possibility of returns for investors for certain use cases.

The push so far into Europe has mainly come from Chinese players, which are at the forefront of battery-swapping. Two approaches have emerged. The first, employed by Tesla rival Nio, is to create a VIP charging experience that it believes complements its premium status.

Nio builds all its cars using a common structure that allows owners of all models to swap batteries at the company's brand-specific stations in about five minutes, giving a vastly better charging experience than plugging and waiting. In terms of benefits to the owner, it eclipses Tesla's Supercharger network in that the process is much quicker (if there are no queues). It doesn't even require the driver to exit the car.

As of the end of July, Nio had installed 1047 swap stations and claimed to have surpassed 10 million battery swaps. Of those stations, just one was built outside China: in Lier, southern Norway. Nio is planning 20 in total in Norway and aims to have two built in Germany by the end of the year to underpin its market launch there. Nio has said it intends to build 4000 battery swap stations by 2025, including 1000 outside China.

However, the business case for Nio looks shaky. We found figures from the company detailing costs of \$772,000 (£588,000) to



Nio is leading proponent of battery swapping



Fleet-focused EVs could benefit from quicker top-up times

build a swap station in China – including the batteries, site leasing (etc) – compared with \$309,112 for a bank of chargers. To make its strategy work, Nio would need a strong network of swap stations to satisfy customer demand for longer journeys, while accounting for the fact that most owners in Europe would usually charge at home.

Therefore, we believe the company needs to licence its technology to other manufacturers to make a good business case, which will be hard, given that most potential customers will be locked into

long-term platform strategies of their own.

The second use case for battery swapping – and the one we believe will gain the most traction – is supporting electric business vehicles driving predictable routes without sufficient downtime for a full recharge.

Again, China is looking to make in-roads here. One battery-swapping trial building momentum focuses on taxis in Berlin. Now into its third year, it is run by a Chinese-German joint venture called InfraDianba, using swap technology from specialist Aulton Dianba and EVs from MG, owned by China's SAIC. The trial is now at the point that InfraDianba is ready to build a swap station at Berlin Airport, on the forecourt of a petrol station owned by France's TotalEnergies, which will operate it from completion in mid-2023.

The company has the backing of Berlin's taxi fleet, which wants support in switching 4000 cars to EVs with battery-swapping



technology. Aulton claims it can change a 50kWh battery in just 20 seconds.

This is a smarter use of the technology: as legislation forces Europe's car parc to go electric, competition for public chargers will climb. Directing high-use vehicles such as taxis and delivery vans away from chargers and into dedicated swap stations will benefit all EV owners, while the regular throughput should generate reliable income for the swap station's operator.

Taxi drivers and companies are also more brand agnostic. For example, the MG 5 SW EV estate is becoming popular with taxi drivers, who like it for its balance of range, space and cost. Aulton says it has licensed its technology to 16 Chinese car brands, and although few might become household names in Europe, they could do good business exporting models with the battery-swap tech for taxi fleets.

Another possibility is that taxi finance companies could import these converted cars from China and then bundle the cost of the car, the battery lease and swaps into one monthly payment for owner-operators.

Another company investing in the technology in China is battery company CATL, which is launching a service called Evogo that claims to swap batteries in less than a minute. It has signed up Chinese car maker FAW, which will install the technology in a new MPV.

And Geely (owner of LEVC, Lotus, Polestar and Volvo) last year announced plans to open 5000 swap stations globally.

Chinese cities such as Wuhan are already encouraging ride-hail fleets to use battery-swapping and are incentivising the construction of swap stations.

China is drafting a national battery-swap compatibility standard for passenger and commercial vehicles. A July meeting of the drafting group was attended by 160 experts from 40 institutions and companies, including the National Technical Committee of Auto Standardisation, battery company CATL said.

There are wider benefits to swap stations. InfraDianba is also talking about the ability to use battery capacity in the swap stations – up to 60x50kWh (3000kWh) in its biggest stations – as energy storage, which could give it a second source of income selling electricity back to the grid

at peak times, providing it can balance the needs of its vehicle customers.

Vans are another good usage case. In Japan, a joint-venture company comprising Daihatsu, Isuzu, Suzuki and Toyota, called the Commercial Japan Partnership Technologies Corporation (CJPT), has teamed up with logistics company Yamamoto Transport to research swappable 'cartridge' batteries.

The new research cites a number of advantages of using swappable batteries. For example, spare batteries can be timed to charge when electricity is cheap, renewably generated or both. All advocates of battery-swapping cite the benefits of slow charging versus rapid charging to preserve a battery's health, which is possible when they're not attached to the vehicle and needed right away.

Another advantage cited by Japan's CJPT is the ability to match the size of the battery to the particular use case of



a commercial vehicle. For instance, city delivery trucks may need fewer cartridges than those on longer delivery routes.

Meanwhile, Nio has said it will offer different chemistries in its swappable batteries: a customer who doesn't need a super-long range can opt for a cheaper subscription to lease iron-based LFP batteries while retaining the option to rent a more energy-dense battery for long journeys.

We think the advantages of battery-swapping and China's determination to make it succeed – on a state level, rather than just a company level – will mean Europe is certain to embrace battery-swapping in some form.

However, we don't believe European manufacturers will adopt it for the majority of their future EVs, given the high expenditure needed and the likely reluctance to adapt platforms to accept mainly Chinese battery-swapping standards.

Battery technologies and structures are changing at such a rate that few car makers would want to be tied to a system limiting their ability to innovate and create economies of scale within a vehicle platform.

Moreover, swapping becomes less of an issue for private drivers who mainly charge at home or at work – who generally have less need of rapid chargers – as charging speeds climb.

But for lower-tech EVs for business use, powered by cheaper battery chemistries, battery-swapping has a future. InfraDianba envisages a zero-emissions future in which forecourts are repurposed with a mix of swap stations, chargers and hydrogen pumps. Further in the future, it foresees second-hand and commercial EVs being equipped with swappable batteries.

With widespread adoption reducing barriers to entry, there's strong reason to think this could be our electric future.

## WHO OWNS THE BATTERIES?



**Nio's flagship ET7 will get 150kWh battery**

**To use Nio's swapping system owners need to lease the battery from Nio for the equivalent of £175 a month for the 100kWh battery in Norway (90kWh usable from swap stations). That cuts the cost of the car by the equivalent of around £7500 and gives two free swaps a month. The cheaper option is the forthcoming 75kWh battery which can be swapped in with no changes, or there's a 150kWh version in the pipeline that will fit newer models such as the brand's Mercedes EQS-rivalling ET7 saloon.**