**I do like a statistic, as you know. So, here’s a couple for you.**

**Between twenty fifteen and twenty-twenty-four, the South Korean battery company Gogoro conducted more than six-hundred and fifty million battery swaps for small motorbikes and scooters across Southeast Asia, apparently saving more than a million tonnes of CO2 emissions in the process.**

**In China, Nio’s EV battery swapping technology has now been embraced by several major Chinese automakers, growing from one hundred and thirty-five swap stations in twenty-twenty, to more than two-thousand-seven hundred in twenty-twenty-four, with plans to reach five thousand in the near future.**

**And now, the world’s largest battery manufacturer, CATL, has just unveiled two different types of swappable batteries and announced what it calls a power charging ecology with nearly one hundred operating partners.**

**It means that for millions of electric vehicle drivers in Southeast Asia, recharging their car will effectively no longer be an issue. They will simply drive into a large box that looks a bit like a car wash, wait for three minutes and then drive out the other side with a newly installed, fully charged, power pack underneath them.**

**In theory, it’s an absolutely brilliant idea that works perfectly as long as all the major manufacturers join in and governments fast track planning applications to get swap stations rolled out at pace.**

**And, with the exception of a couple of small-scale trials in the San Franciso Bay Area, precisely none of that activity is currently going on in Europe or North America, where car makers are fiercely proprietorial about their designs and, at least on the face of it, look extremely unlikely to voluntarily standardise their vehicles to accommodate a single harmonised battery shape and size.**

**So, despite on paper looking like a stroke of genius, does battery swapping have any chance whatsoever of catching on over here?**

**Hello and welcome to Just Have a Think.**

**As the world’s largest and arguably most influential battery maker, CATL generally gets pretty good publicity whenever it makes a new, apparently groundbreaking announcement, although if you’re over in the States, you’re more likely to have heard the recent news that the US government has designated CATL as a Chinese military operation.**

**That’s a whole other story though, that I’ll leave for other YouTubers to explain.**

**Despite that shot across the bows from China’s fiercest competitor, CATL continues to go from strength to strength.**

**This latest announcement brings two different types of standard swappable batteries, which the company has branded as "choco-swap".**

**The two packs are based on two different systems, offering either lithium iron phosphate or Nickel Manganese Cobalt chemistries with various capacities depending on the vehicle in question. CATL claims a swap out time of just one hundred seconds and ranges of four hundred to six hundred kilometres, again depending on the model. The company isn’t messing about either. They plan to have a thousand swap stations built out in twenty-twenty-five alone, with the stated ultimate goal of THIRTY thousand across the whole of China in the fullness of time.**

**What this essentially represents is a bit of stiff competition to rival the fast-growing Nio network that I mentioned earlier. That ought to be good news for the hundreds of millions of electric vehicle owners in the world’s second most populous country.**

**What would really be ideal though of course, is if CATL and NIO got together with all the other manufacturers and agreed a set of standard battery chemistries, with a standard set of physical shapes and sizes and a standard range of capacities to suit every vehicle model. And that brings us neatly to a slightly deeper analysis of the pros and cons of the battery swap phenomenon.**

**I think we all get the obvious advantage of driving in with an empty battery and out again with a full battery in the same amount of time as it takes to fill up an internal combustion engine with fuel. So that gets a check in the plus column. And by the way, the vehicles that take these batteries still have their own charge port, so if you don’t want to use the swap station you can simply charge up via a cable at home or on the public charging network if that’s more convenient.**

**Critics of the rapidly accelerating electric vehicle revolution are quick to suggest that grids all over the world are about to be overwhelmed by the additional pressure that millions of charging EV batteries will create. That’s mostly a nonsense argument, for reasons that you can discover by clicking on the link above my head here or in the description section below. But nevertheless, grid stability is an obviously essential factor in the energy transition, and in that respect, battery swapping could prove to be extremely useful indeed.**

**Swap stations typically hold megawatt hours-worth of battery energy storage at any given time. That means they can act as grid support units, helping with frequency regulation, peak shaving and trough filling. They can also relieve some of that perceived grid over-burden because the swap station itself doesn’t have the urgency to recharge all its batteries in just a few minutes. The stored batteries can be more slowly charged throughout the day, or charging can be held back until off-peak periods, all controlled by the inevitable algorithm that calculates the state of charge of each unit and ensures there are always enough full batteries to fulfil anticipated demand. Plus, stations can function reliably off-grid in a power cut using the stored batteries to power their operations.**

**From a consumer point of view, you could argue that choosing the battery swap option is a great way to future proof your vehicle, because the swap station operators will continue to update their stock with the latest chemistry improvements.**

**And drivers can choose the capacity size they require for a given application. If you just need to do a bit of mooching around town on a given day, then you might opt to swap out for a cheaper unit with lower capacity. And then when a longer road trip comes along you can go back and get a new battery that will provide you with the much longer range that you require. NIO already offers this option in its swap stations. I’ll come back to that a bit later on.**

**From an environmental point of view, when batteries eventually reach the end of their first life as motive power providers, it’ll be much easier and safer to have them collected and sent away either for redeployment into a second life as stationary energy storage or redirected to the recycling facility.**

**Against all of that lovely stuff, you’ve got massive up front infrastructure costs, a larger physical footprint for all the swap stations and all sorts of permitting hurdles to overcome. Then there’s the operational and maintenance costs. Will these things run autonomously with no on-site human supervision? If so, then security will be a bit of an issue to be addressed too.**

**But the biggest challenge must surely be that standardisation issue that I mentioned at the start of the video. No doubt we’ve all experienced the frustration of non-standardised charging cables and ports on relatively simple devices like mobile phones. That now looks to have been largely resolved, at least here in Europe anyway, with the EU’s recent USB-C mandate that has even brought the mighty maverick Apple into compliance.**

**But it may not be quite so straightforward with vehicle batteries. One of the key design parameters employed by all vehicle OEMs is the need to optimise range, weight, handling and performance. And that has led to battery packs forming an integral part of the overall vehicle design - sized and shaped to be as neat and safe, and in some cases even structural supportive, as possible. Moving to a standard set of formats for all makes and models, with harmonised battery chemistries and battery management systems, would impose some serious limitations in flexibility and innovation, so it will likely be an uphill struggle to persuade car makers, especially in the narrow minded ‘don’t tell me what to do’ capitalist environments of our western democracies, to fall into line and give up their own intellectual property in favour of some generic option that they have much less control over.**

**Then there are rows and potential litigation over who would be responsible if a battery proved to be defective or, God forbid, caused damage to a vehicle. Could be a bit of a minefield!**

**And what price will consumers be prepared to pay for the relative convenience of battery swapping?**

**Well, Nio would argue that not having to pay for the battery as part of your initial vehicle purchase actually brings electric vehicle ownership within the scope of affordability for hundreds of millions of less wealthy citizens and facilitates what industry bods have now dubbed ‘Batteries as a Service’ or BaaS.**

**The company recently unveiled a new pricing structure that moves away from a relatively high fixed service fee plus the cost of each kilowatt hour consumed. That older scheme tended to encourage users to eek out every last ounce of power from their battery packs to minimise the number of service fees they had to pay.**

**That was causing bottle necks in availability and of course it wasn’t doing the batteries any good either. The new system is based primarily on the amount of energy swapped. The aim here is to encourage more frequent battery swaps, potentially improving the overall user experience.**

**Drivers can now either pay a minimal basic service fee of about a dollar forty per swap, plus a combined rate for electricity and service based on the energy exchanged, OR they can simply pay a total unit price per kWh that includes both electricity and service costs.**

**CATL is also offering a couple of subscription options for its users. Owners of AO class vehicles can either pay about fifty dollars a month for a forty-two kilowatt-hour LFP battery and a maximum of three thousand miles, or about sixty-five bucks for an NMC battery with unlimited swaps and mileage.**

**Larger A/B class vehicle drivers will pay roughly seventy dollars or eighty dollars for the same two service options. The company has said that ten EV models equipped with swappable Choco-SEB battery packs will launch in twenty-twenty-five under partnerships with GAC, BAIC, Wuling, and FAW.**

**CATL’s CEO, Robin Zheng, seems quite cock-a-hoop about the whole idea. He reckons that**

**“By 2030, battery swapping is expected to meet one-third of the energy replenishment needs for electric vehicles”.**

**I must admit I’m not quite so confident, especially here in the West. But what do I know, eh?**

**Apparently, Nio is trialling thirty swap stations in Northen Europe. The Bay Area experiment, operated by a company called Ample, has received rave reviews from fleet operators and taxi drivers, and several western automakers are expressing real interest in investigating the possibility of standardised battery packs for their vehicles.**

**So you never know. Industry analysts seem to be erring towards a model where battery swapping performs a fairly limited function, perhaps as a complementary service to the much more well-established public charging networks, probably coming into their own in dense urban areas, especially for fleets vehicles, heavy duty vans and trucks, and of course for gazillions of two-and-three-wheelers.**

**But what’s your view? Is this the stroke of genius that could tip the balance in the EV transition, or is it another flight of fancy that’ll ultimately fall by the wayside? Whatever your opinion, the place to leave your thoughts, as always, is in the comments section below.**

**That’s it for this week though. Thanks, as always to the amazing folks over at Patreon, who literally make this channel possible and allow me to keep making weekly videos without having to bother you with ads and sponsorship messages.**

**If you feel you’d like to get involved with that then jump over to Patreon dot com forward slash just have a think to find out how you can join the team and have a look at all the exclusive perks you can get there, including free membership. And if you enjoyed this video then you really can hugely support me by hitting the subscribe button on YouTube and clicking on all notifications. It won’t cost you a penny to do that and it’s just a simple click away, either down there or on that icon there.**

**Most important of all though, thanks very much for watching! Have a great week, and remember to just have a think.**

**See you next week.**