**Back in March twenty-twenty-two I made a video looking at a new sodium-ion battery technology being developed by the Chinese battery behemoth, CATL, and I came up with an uncharacteristically confident prediction…**

**“If I was a betting man, I’d say we may well be seeing electric vehicles powered by sodium-ion batteries in the next few years.”**

**Well, not for the first time and most probably not for the last, I was wrong. It turns out that EV’s using sodium-ion batteries won’t start hitting the markets in a few years times after all. Because they’ve already arrived, right now, in early twenty-twenty-three.**

**We didn’t just get one major battery breakthrough announcement this month though. We got three of them - all from different high-volume manufacturers, all of whom come at the problem of battery efficiency and longevity from a slightly different angle, and all of whom look like they could catapult the electric vehicle industry up to the next level of market disruption.**

**So, yet another slightly utopian piece of marketing, or a proper set of gamechangers?**

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

**I know, I know, you’ve seen countless videos about ‘breakthrough’, ‘game-changing’, ‘market disrupting’ battery technologies in recent years. Many of them have been produced by me to be fair, so I’m just as culpable as anyone else on the YouTubey thingybob. BUT, NOT covering those technologies wouldn’t be much help either would it? So, you know, suck it up. Leave a pithy admonishment in the comments section if you like. I always enjoy them.**

**Anyway… what are these three fabulous new technologies Dave, I hear you cry? Well, I’ve given you one of them already, haven’t I? It’s sodium-ion batteries. No, no! Don’t switch off! but bear with me! The real breakthrough here is that these things have now been showcased in an actual road car. It’s not a big road car, I’ll grant you, but that may be no bad thing. Not everyone wants a huge electric SUV do they..? a point that’s regularly made by Robert and Jack over at the Fully Charged Show…Oh, and did I mention I’ll be appearing on a couple of discussion panels at their forthcoming UK Fully Charged LIVE events? I didn’t? Well… run VT!**

**Anyway, as I was saying, anyone who regularly watches the fabulous Fully Charged Show will know that the market is crying out for small inexpensive electric vehicles that can do normal journeys like a daily commute, without blocking everyone else’s view of the road and requiring two parking spaces when they arrive at their destination.**

**This little thing is the creation of the JAC group over in China, with some considerable technical input from none other than Volkswagen.**

**They’re actually not using the CATL sodium-ion battery that I mentioned earlier, they’re using a similar technology from a little- known Chinese outfit called Hina Battery Technologies.**

**It’s probably worth a quick recap on why sodium-ion technology might be a good replacement for lithium-ion.**

**Lithium and sodium are part of the same group of highly reactive elements known as the alkali metals.**

**Lithium is more reactive than sodium and it has of course become the default technology of modern-day energy storage.**

**But lithium is not all that common. The only really large reserves are in Argentina, Chile, Australia and China, and for reasons that I’m sure you’ve read about in the news, the price of lithium has gone completely interstellar recently. So, battery makers are doing what all good engineers and entrpreneuers do – they’re working on alternative solutions to the problem, which is where sodium comes in. There’s more than a thousand times more sodium in the earth’s crust than there is lithium. It’s a constituent part of sodium chloride, which is of course salt. It’s actually mostly mined from soda ash, but in any case, as the sixth most abundant element on the planet, it’s pretty easy to get hold of. The President of Hina Battery Technologies, Li Shujun, reckons sodium-ion batteries could eventually slash the overall production costs of electric vehicles by ten per cent.**

**The basics of lithium and sodium-ion batteries are very similar, with electrodes on either side of an electrolytic solution with a separator membrane in the middle. During a charging cycle, the lithium or sodium atoms release electrons from the cathode via an electrical wire to the anode on the other side, while the lithium or sodium ions travel across the electrolyte to reach the same destination.**

**When the system is connected to a device, everything moves in the opposite direction and the electrons power the device. The two main drawbacks of sodium are energy density and weight. The Hina battery has an energy density of a hundred and forty watt-hours per kilogram, which is a lot lower than NMC lithium-ion batteries that use nickel, manganese and cobalt. But that’s really not an issue in a little car like this that’s designed to scoot around town or do relatively low distance journeys. It’s also not a problem for things like electric scooters or bicycles and motorbikes, or even for buses which, let’s face it, are not on this earth to break any land speed records are they?**

**As well as generally better availability, sodium-ion batteries have other significant advantages. They have much better performance at very low temperatures than lithium-ion batteries, and they have relatively fast charging times. They can also generally be recharged more often with less degradation, which means they’ll last longer too.**

**This JAC Sehol E10X test vehicle has been fitted with a 25 kilowatt-hour battery that can apparently do two hundred and fifty kilometres, or about a hundred and fifty miles, and can be fully charged up in about fifteen minutes. The current Sehol E10X model that carries normal lithium-ion batteries costs six thousand eight hundred dollars, so if they can get this new sodium-ion version anywhere near that price point then it could be a winner.**

**Not to be outdone though, on the 18th of April twenty-twenty-three, another Chinese automotive giant, BYD, launch their own sodium-ion powered electric vehicle, called the Seagull. It’s a good looking five door hatchback with a thirty-kilowatt hour battery, a claimed range of three hundred and five kilometres, or a hundred and NINETY miles and a price tag of eleven thousand six hundred dollars. BYD clearly believes in sodium-ion technology because they say they plan to fit these batteries into all their sub thirty-thousand-dollar models. And these big players are dealing with a seriously accelerating market over there in China. Swiss bank UBS recently forecast that by twenty-thirty, three out of every five new vehicles sold in China will be electric. Just for reference – that’ll equate to about sixteen million units a year.**

**The world’s largest battery maker, CATL, will no doubt play a big part in the sodium-ion revolution. It was, after all, their technology that I originally featured in my video last year. But they are not a company to rest on their laurels, and while sodium-ion will take some time to reach market maturity, CATL have been looking at ways to make existing technology work better. The result of that research is something they call the Qilin battery. CATL actually unveiled this technology back in 2022, telling us it heralded the advent of EVs with a thousand kilometres of range. Essentially what they’ve done is to manufacture blade cells that are stacked vertically on a common plate. Each cell is separated by a second thinner plate filled with a coolant. CATL say this configuration allows for far greater thermal control, and one of the main benefits of that is that they can really ramp up the charging speed without exploding the battery. Which is a nice feature if you’re the car owner. They reckon they can get zero to eighty percent charge into one of these things in just ten minutes. But perhaps the boldest claim the company makes is that their new battery architecture has increased the volume efficiency by seventy two percent. That translates to a gravimetric energy density of two hundred and fifty-five watt hours per kilogram for their standard NMC cells and a hundred and sixty watt hours per kilogram for their LFP technology. The first vehicle fitted with these cells is this fairly ugly article known as the [Zeekr 009 MPV](https://www.arenaev.com/zeekr_009_mpv_launches_with_catl_140kwh_qilin_battery-news-950.php), but it will be its smaller sibling, the [Zeekr 001](https://www.arenaev.com/2023_zeekr_001_has_optional_qilin_battery_with_1032_km_range-news-1235.php), that will offer the thousand kilometre range.**

**Now, if all this talk of Chinese dominance in the EV markets is something you find slightly unnerving, then either..you know..get used to it…OR –here’s a fantastic game changing breakthrough technology from the good old US of A.. This offering comes to us from a six hundred-million-dollar, New York Stock Exchange listed company called Amprius.**

**It's a lithium-ion pouch cell that replaces the graphite anode with a one-hundred-percent silicon anode. Silicon has the highest capacity for storing lithium among all the elements in the periodic table, but it has a nasty tendency to swell up as it receives lithium into its structure. That causes distortion and cracking that can significantly shorten a cells operational lifecycle. It’s a problem that apparently stopped Tesla in their tracks when they tried to develop a similar technology. But, after more than a decade of development, Amprius say they have overcome this challenge via a unique anode configuration that doesn’t use any conductors 9:37 or binders or other matrix supporting materials. What they’ve achieved is a highly engineered web of pure silicon nanowires with its own internal porosity that allows lithium inside without wrecking the structure. Each nanowire is directly attached to the current collector, which optimises the movement of electrons out into the electrical circuit.**

**The folks at Amprius say they’ve achieved an independently verified cell density of no less than five hundred watt-hours per kilogram, which is more than twice the density of a Tesla forty-eight-sixty cell and about seventy five percent higher than Ford’s pouch technology. That kind of cell density will have a huge impact on vehicle range and the lifetime of electronic devices, but the primary focus for Amprius right now is actually providing power for the aeronautics industry. The company is actively engaged with more than thirty customers, including AALTO Airbus, AeroVironment, BAE Systems, Teradyne FLIR, and the U.S Army, all of whom have been able to validate the Amprius cell performance numbers.**

**So, let’s cut to the chase. Are they on the market right now?**

**Yeah/ no…no they’re not.** **Well, at least not this five-hundred watt hour version anyway, although to be fair to Amprius they have been in commercial production since twenty eighteen and their four hundred and fifty watt hour battery has been available since twenty twenty two. Amprius say the five hundred watt hour version will be available for shipment this year, and although we don’t have costs yet, Amprius tell us that they are currently building a seven hundred and seventy-five thousand square foot facility in Brighton, Colorado with a five-gigawatt hour manufacturing capacity, due to come online at the beginning of twenty-twenty-five. Plus, their headquarters, R&D lab and pilot manufacturing facility all just happen to be located in Fremont, California, right next to Tesla’s giga factory, so, you know…just saying!**

**The prize is big, not just in the automotive sector but also in aviation. Those two markets combined are projected to require about a hundred billion dollars-worth of battery power by twenty-twenty-five. So, as usual… watch this space!**

**There we are then folks. Three very encouraging developments. And despite my somewhat flippant and sarcastic approach to this week’s video, in all seriousness, these are precisely the kinds of scientific and engineering developments that are going on all over the world right now and which should be giving us average citizens a little bit of hope that we’re moving ever faster to the sort of market disruption tipping points that people like Tony Seba and his colleagues at RethinkX have predicted for the middle of the twenty-twenties. These technologies on their own won’t solve all of our problems of course, but specifically, they will accelerate the move away from internal combustion engine vehicles. And that is most certainly a major imperative in the green transition.**

**That’s it for this week. “Before I go, I just want…No, no we’ve done that. We did it earlier…Oh go on then! [Fully Charged VT]**

**Thanks, as always to the channel’s fantastic Patreon supporters, and a special shout out to some folks who joined recently with pledges of ten dollars or more a month. They are**

**Robert Strader**

**John McLaughlin**

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**And of course, a big thank you to everyone else who’s joined since last time too.**

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