DRIVEMODE

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Electric cars - Making the move from niche to mainstream

Battery electric vehicles (BEVs) are gaining in popularity among Europe's car buyers, but their high cost is holding them back from wider acceptance. However, developments in technology, particularly in the area of modular powertrains, could be the answer to bringing down their price

Battery electric cars are slowly gaining in popularity among consumers in Europe as mainstream automakers respond to an industry-wide shift away from petrol and diesel vehicles. But despite pledges from regional governments to abolish sales of new combustion-engine vehicles in the next two decades, and pressure from the European Union to reduce carbon emissions, consumers are still not opting for battery-driven models in the numbers that are needed to turn them from a niche segment to mainstream one.

Data released this month from Europe's ACEA industry association shows that despite a 10.5% rise in electrified vehicles last year, driven by a 117% jump in BEVs, **petrol and diesel models still commanded an overall 75.5% share of European sales**.

Volkswagen Group, the world's second biggest automaker by volume after Toyota, is currently investing 73 million euros up to 2025 to prepare its German plants in Hanover, Emden and Zwickau for the production of BEVs.

Despite this, just 231,600 cars sold by the automaker last year were full-electric models, from overall global sales of 9.3 million vehicles.

This project has received funding from the European Union's Horizon 2020 research and Innovation programme under grant agreement N° 769989.

One of the biggest problems BEVs face is their price. As an example, Opel's entry-level full-electric e-Corsa currently costs 29,900 euros in Germany, whereas its petrol-driven sibling starts at 14,415 euros, less than half the price.

Part of the reason for the high pricing is a **lack of uniformity in production**. Automakers are only now beginning to produce universal electric platforms that can be scaled up or down for different-sized vehicles segments. Electric drivetrains, however, are still largely built in a bespoke fashion for different BEVs.

There are other big hurdles that impact the cost of BEVs, and they include **the cost of batteries and high raw material costs**.

One European Union research project addressing all these issues is Drivemode. It seeks to develop a **highly efficient and compact modular drivetrain for BEVs** that uses the vehicle's stored energy more efficiently through a higher-voltage 800-volt electric system. Currently, most automakers are using 400-volt systems.

"With Drivemode we have a very integrated unit. That way it makes [everything including] the assembly process, the sourcing, the storing and the assembly, to putting it in the vehicle, very optimal, so you have a reduced production cost," explains **Deepak Singh**, an engineer from National Electric Vehicle Sweden (NEVS), one of the project's partners.

In Singh's opinion, **automakers are still taking a complicated approach by implementing varying electrical setups for each vehicle segment** they design a BEV for, whether that is a passenger car or a light commercial vehicle, such as a van.

"It makes it very difficult to do a quick product placement in the market," Singh says. The project's modular system on the other hand brings together **the electronics, a gearbox, and the motor in a unit that can be scaled up** according to the power requirements of a given vehicle. Put simply, that means that one of the modules could be used to drive a small city car, while a sports-car might require four modules. This approach would have an obvious effect in reducing the cost of building mass-market BEVs.

Watch the video interview on scalability of drivetrain modules with Deepak Singh, NEVS, Sweden

Drivemode's use of an 800-volt electrical system also helps address other cost hurdles. In general, motor size is defined by torque capability. The higher-voltage systems, which run at speeds of 20,000 rpm, need less torque to achieve efficiency, meaning that they can be smaller in size and weight.

The use of **smaller motors** means that cars will be lighter than those with larger units and consequently can travel further on less battery power.

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Batteries are currently the most expensive single item in EVs, and although their cost is falling fast, they are seen as currently making up about a quarter of the overall price.

This leads Singh to suggest that the conventional wisdom from automakers to add more battery capacity to boost range could be the wrong approach." **Bigger batteries and longer range are not the optimal solution** to go for. Most of the auto manufacturers are going in that direction, packing in more batteries for a longer range. But in my opinion, it should be a **higher voltage system with ultra-fast charging** and a medium sized battery not a large battery."

This is an opinion echoed by many industry observers including JATO Dynamics auto analyst **Felipe Muñoz**: "Big range might be the trendy topic in the BEV world right now, but I'm sure in the near future, many consumers will prefer a more affordable BEV than a very long range one with a higher price tag."

Higher-voltage systems such as Drivemode's can **cut charging times by up to 75 percent** in vehicles using high-speed chargers. In the real world this means that a car such as the Porsche Taycan, currently the only commercial 800-volt vehicle on the market, can be charged to 80 percent of its battery capacity in just over 20 minutes.

This helps make a smaller battery range more acceptable to consumers by bringing down the time they need to charge. "It's better to have less battery power and faster charging systems than spending one hour every time you need to fully charge your big battery," Muñoz says.

Another cost-saving advantage of smaller high-voltage motors is a **reduction in the use of precious materials such as copper**, which is achieved through a decrease in electrical current to the motor.

A small electric car (using a 400-volt electrical system) currently contains about 40 kilograms of copper, roughly four times its combustion-engine equivalent. But despite the slow take up of electrification in Europe currently, industry observers are optimistic that **BEVs will reach price parity with internal combustion models this decade**.

Matthias Schmidt at Schmidt Automotive Research in Berlin expects this to happen in around **four years**, but believes it will be down to the costs of meeting new emissions standards, rather than any dramatic fall in BEV prices, because such technology "will increase the cost per unit for ICE (internal combustion engine) technology to meet the new Euro 7 technology level."

And while Munoz thinks parity could arrive in 2023, he expects that this will likely only be in premium segments, with parity in mass-market segments arriving later in the decade.

By David Jolley

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