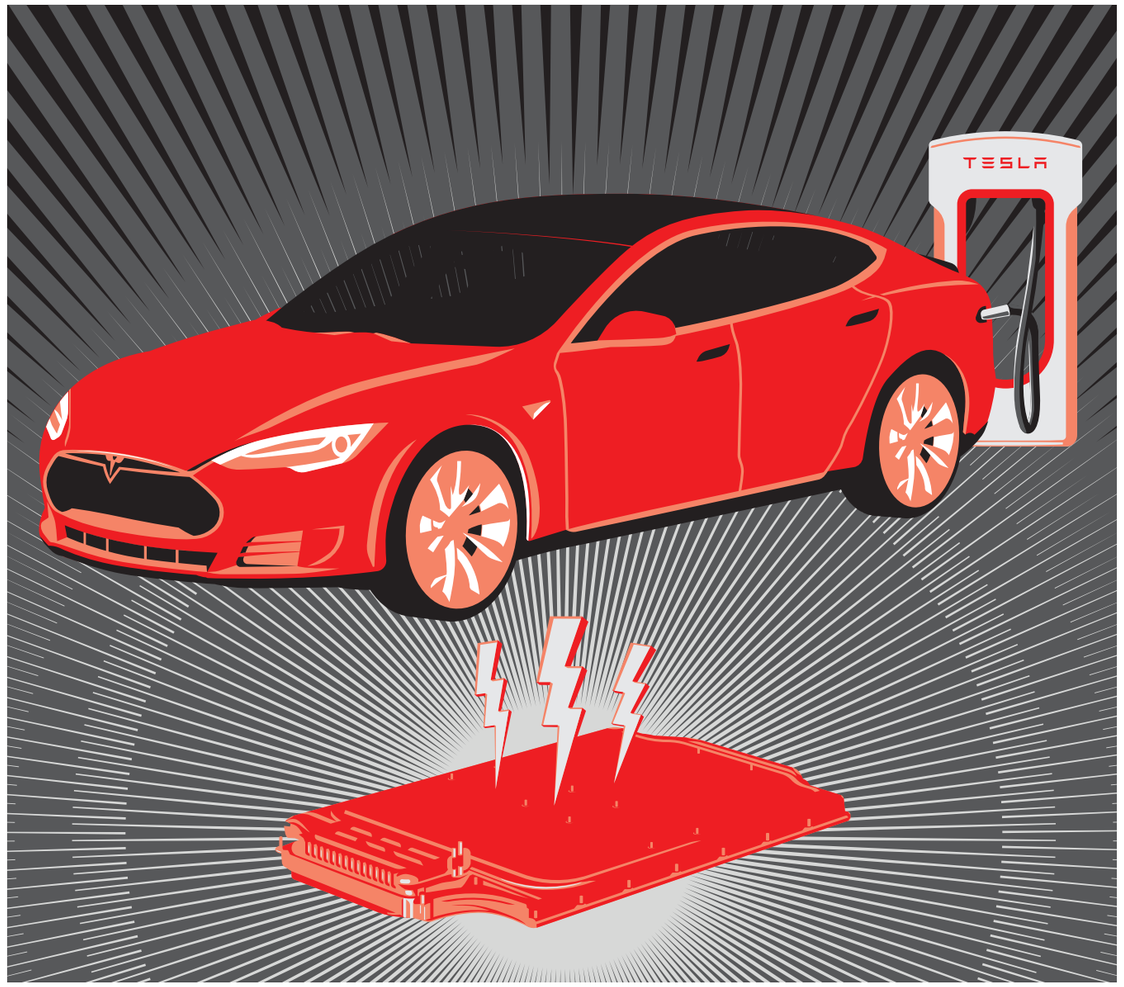

CLEAN ENERGY

ELECTRIC ENABLER

Tesla batteries are making EVs affordable.

STORY BY JOHN KOSOWATZ • ILLUSTRATION BY THOMAS ROMER

In the last year, electric vehicles have broken through with their most skeptical audience: legacy automakers. In October, General Motors joined Ford, Volvo, Nissan, and others in announcing that a substantial portion of its future production will be powered in part or entirely by electricity.

The rush toward emission-free vehicles is only possible because of a dramatic drop in the cost of producing batteries to power them. That game-changing price cut is credited to a small automaker with a commitment to electric vehicles: Tesla Motors.

Tesla's battery revolution began when CEO Elon Musk declared that it would sell a mass-market EV for just $35,000. To produce battery packs cheaply enough to reach that price point Tesla re-engineered not only the production process, but the factory in which the batteries are made.

The Reno, Nev., Gigafactory is not yet operating at full capacity but it is expected to produce 35 GW per year of lithium-ion batteries, about double the present-day global production. Costs are not released publicly but most industry observers believe the company already has brought them below $200 per kWh.

Tesla partnered with Panasonic to revamp the production process, and ended up redesigning the chemistry of the battery itself. The standard "18-650" cell format used thousands of less expensive commodity cells, similar to lithium-ion batteries used in laptop computers. Tesla replaced individual safety systems built into each cell with an inexpensive fire-proof system for the entire battery pack. Now, they've begun producing the new "2170" cell, which is named after its dimensions of 21 mm by 70 mm. It delivers higher density through an automated system developed with Panasonic to further reduce costs.

For now, Musk says the 2170 will be used in the Model 3 and its Powerwall and Powerpack storage units for solar electricity.

"We're doing our best to change the nomenclature of the industry," Kurt Kelty, Tesla's former director of battery technology, told an industry gathering last year. "We've been using the 18-650 because it existed but it is not the optimal size for EVs." The company thinks the new battery format improves sizing and energy density specifically for electric vehicles. But the challenge was to reduce production costs by 30 percent.

Tesla attacked that partly through partnering with mining companies to guarantee cost and supplies of raw materials, which Kelty says are the biggest cost drivers. Nickel is the largest raw material cost, Kelty said, followed by graphite, lithium, and cobalt. The firm believes the sourcing of needed raw materials will remain steady for the next five years, though resource constraints may crop up if the electric vehicle market surges.

Even better batteries may be on the horizon. A research partnership with NSERC/Tesla Canada Industrial Research has lab-tested battery cells capable of doubling the lifetime of Tesla's batteries. According to the group's chairman, pioneering battery researcher Jeff Dahn, the aluminum coating used by the group performed so well, he thinks the batteries could last 20 years.

That development has not yet been incorporated into Tesla's products, but it certainly holds out the promise of even greater efficiencies and a longer battery—and vehicle—life. ME

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AFFORDABLE ENERGY STORAGE

INNOVATORS Tesla Motors; Kurt Kelty, former director of battery technology.

INNOVATION Optimizing the chemistry and manufacturing process to bring down the cost of lithium-ion battery packs.

IMPACT Less expensive energy storage will help electric vehicles reach the mass market, cutting tailpipe emissions from cars and trucks.


Kurt Kelty