High Battery Cost Curbs Electric Cars

Unlike Other Devices, Power Packs May Not Enjoy Major Economies of Scale

By MIKE RAMSEY

The push to get electric cars on the road is backed by governments and auto makers around the world, but they face a big hurdle: the stubbornly high cost of the giant battery packs, which can account for more than half the cost of an electric vehicle.

Both the industry and government are betting that a quick takeoff in electric-car sales will drive down the battery prices. But a number of scientists and automotive engineers believe cost reductions will be hard to come by.

Unlike with tires or toasters, battery packs aren’t likely to enjoy traditional economies of scale as their makers ramp up production, the scientists and engineers say.

These experts say increased production of batteries means the price of the key metals used in their manufacture will remain steady—or maybe even rise—at least in the short term. They also say the price of the electronic parts used in battery packs as well as the enclosures that house the batteries aren’t likely to decline appreciably.

The U.S. Department of Energy has set a goal of bringing down car-battery costs by 70% from last year's price by 2014.

Jay Whitacre, a battery researcher and technology policy analyst at Carnegie Mellon University, said in an interview the government’s goals "are aggressive and worth striving for, but they are not attainable in the next three to five years." He predicted "it will be a decade at least" before that price reduction is reached.

Current industry estimates say the battery pack in the all-electric Nissan Leaf compact car coming out in December costs Nissan Motor Co. about $15,600.

That cost will make it difficult for the Leaf, which is priced at $33,000, to turn a profit. And it also may make the Leaf a tough sell, since even with federal tax breaks of $7,500, the car will cost about twice the $13,520 starting price of the similar-size Nissan Versa hatchback.

Nissan won’t comment on the price of the battery packs, except to say that the first versions of the Leaf won’t make money. Only later, when the company begins mass-producing the battery...
units in 2013, will the car be profitable, according to Nissan.

The Japanese company believes it can cut battery costs through manufacturing scale. It is building a plant in Smyrna, Tenn., that will have the capacity to assemble up to 200,000 packs a year.

Other proponents of electric vehicles agree that battery costs will fall as production ramps up. "They will come down by a factor of two, if not more, in the next five years," said David Vieau, chief executive officer of A123 Systems of Watertown, Mass., a battery maker that recently opened a plant in Plymouth, Mich.

Alex Molinaroli, president of Johnson Controls Inc.'s battery division, is confident it can reduce the cost of producing batteries by 50% in the next five years, though the company won't say what today's cost is. The cost reduction by one of the world's biggest car-battery makers will mostly come from efficient factory management, cutting waste and other management-related expenses, not from any fundamental improvement of battery technology, he said.

But researchers such as Mr. Whitacre, the National Academies of Science and even some car makers aren't convinced, mainly because more than 30% of the cost of the batteries comes from metals such as nickel, manganese and cobalt. (Lithium makes up only a small portion of the metals in the batteries.)

Prices for these metals, which are set on commodities markets, aren't expected to fall with increasing battery production—and may even rise as demand grows, according to a study by the Academies of Science released earlier this year and engineers familiar with battery production.

Lithium-ion battery cells already are mass produced for computers and cellphones and the costs of the batteries fell 35% from 2000 through 2008—but they haven't gone down much more in recent years, according to the Academies of Science study.

The Academies and Toyota Motor Corp. have publicly said they don't think the Department of Energy goals are achievable and that cost reductions are likely to be far lower. It likely will be 20 years before costs fall by 50%—not the three or so years the DOE projects—a according to an Academy council studying battery costs. The council was made up of nearly a dozen researchers in the battery field.

"Economies of scale are often cited as a factor that can drive down costs, but hundreds of millions to billions of ... [battery] cells already are being produced in optimized factories. Building more factories is unlikely to have a great impact on costs," the Academies report said.

The report added that the cost of the battery-pack enclosure that holds the cells is a major portion of the total battery-pack cost, and isn't likely to come down much.

In addition, battery packs include electronic sensors and controls that regulate the voltage moving through and
the heat being generated by the cells. Since those electronics already are mass-produced commodities, their prices may not fall much with higher production, the study said.

Lastly, the labor involved in assembling battery packs is expensive because employees need to be more highly trained than traditional factory staff because they work in a high-voltage environment. That means labor costs are unlikely to drop, said a senior executive at one battery manufacturer.

When car makers began using nickel-metal hydride batteries, an older technology, in their early hybrid vehicles, the cost of the packs fell only 11% from 2000 to 2006 and has seen little change since, according to the Academies study.

Toyota executives, including Takeshi Uchiyamada, global chief of engineering, say their experience with nickel-metal hydride batteries makes them skeptical that the prices of lithium ion battery pack prices will fall substantially.

"The cost reductions aren't attainable even in the next 10 years," said Menahem Anderman, principal of Total Battery Consulting Inc., a California-based battery research firm. "We still don't know how much it will cost to make sure the batteries meet reliability, safety and durability standards. And now we are trying to reduce costs, which automatically affect those first three things."
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Write to Mike Ramsey at

michael.ramsey@wsj.com

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4 of 4 10/19/10 9:37 AM