Carmakers Find Ways to Make Cheaper Hybrids

As automakers work to comply with fuel-economy standards, they're increasingly turning to hybrids. Last week, for example, Toyota announced that it would make 21 hybrid models by 2015, up from 12 [1] now. Automakers have grown more enthusiastic about hybrids because the cost of making them has plummeted.

Several years ago, Toyota's Prius hybrid cost the consumer about $6,000 more than an equivalent conventional car — and even at that price, the company was losing money on every one it sold. The difference is now $2,500, and the car is profitable, says Mike Omotoso, an analyst with LMC Automotive [2]. The drop in cost is due to an accumulation of incremental technology improvements, along with economies of scale. And advances going forward — better batteries, electric motors and power electronics and transmissions — could cut costs by another 50%.

At Toyota, for example, the company shifted from a 500-volt electrical system to a 650-volt one, a decision that produced "a host of benefits," says Justin Ward, advanced power-train program manager at the Toyota Technical Center [3]. The company was able to reduce the cost and weight of copper wiring, use cheaper power transistors in the electronics that control the hybrid system, and make the electric motor cheaper and smaller.

Although other automakers have shifted to lithium-ion batteries, Toyota has stayed with nickel-metal hydride. But it's made improvements to these batteries, such as shifting from cylindrical cells to flat ones to save space and modifying the cases to improve battery cooling. Simple changes like moving connectors from one side of a circuit board to the other can have big implications in terms of manufacturing, Ward says, making it possible, for example, to replace a worker with a robot for an assembly step.

All hybrid manufacturers have had to cope with the rising costs of rare-earth metals, which are used in the compact, highly efficient motors that propel hybrids in conjunction with their gasoline engines. So Toyota and other major automakers are redesigning their motors either to not need rare earths or to use far less of them.

Ford has helped develop motors that halve the required amount of dysprosium — the most expensive rare-earth material in its motors, used in part to give the magnets resistance to heat. Ford developed a better motor cooling system, which lessened the need for dysprosium. Simultaneously, its supplier, Hitachi, developed a better process for diffusing the material through a magnet, also allowing the use of less of it. This and other advances have helped Ford lower hybrid costs by about 30%.

Even as Toyota is increasing the number of its hybrid models, GM is dropping its conventional hybrids in favor of the much cheaper (and less fuel-efficient) eAssist vehicles — hybrids that use a motor together with a small battery that allows the engine to turn off whenever the car comes to a stop.

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