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## 2011 Nissan Leaf

The forthcoming Nissan Leaf hatchback will move the electric car much closer to the real world, and well beyond the few boutique electric vehicles available to consumers now.

The Leaf will almost certainly be first in the next-generation of pure electric cars from a large volume, mainstream automobile manufacturer. It runs on batteries without a combustion engine to supplement its electric motor or generate electricity, and it's designed for typical drivers to use every day. The Leaf should be available to consumers in the United States before the end of 2010, according to Nissan.

Slightly larger than the familiar Nissan Versa subcompact, the zero-emissions Leaf is a peppy car with room for five and good cargo space. Its 100-mile range surpasses the daily needs of all but the furthest traveling commuters, and it's loaded with things intended to make ownership even easier.

The secret to the Leaf, and perhaps the closest thing to a breakthrough, is hidden in its battery pack. Unless the widely touted Chevy Volt hybrid beats it to market, the Leaf will be the first volume-produced car with lithium-ion batteries. Now familiar in laptops, mobile phones and other small appliances, Li-ion batteries were long considered poorly suited for automotive applications. Nissan, though, has been developing them for the purpose jointly with NEC electronics since 1992.

The Leaf's battery is actually an array of laminated lithium-ion sheets manufactured from manganese. Each sheet is a 12-by-10 inch rectangle, about half an inch thick, stacked in metal-encased modules weighing a total of 395 pounds. Nissan says the Li-ion batteries have twice the storage capacity of any batteries used in current automotive applications. They charge and operate at lower temperatures than lead-acid or ni-cad batteries, according to engineers, and after five years of daily drain cycles, they retain 80 percent of original capacity.

The value of the Li-ion battery pack is simple enough: It gives the Leaf a range of 160 kilometers per plug-in charge, or a tick under 100 miles, in the typical urban driving cycle. According to Department of Transportation data, 98 percent of all American drivers drive less than 100 miles per day.

The compact Li-ion modules gave designers great flexibility in creating the Leaf. The batteries fit in a purpose-designed electric vehicle frame, stacked between the wheels under the interior floor. The design adds rigidity to the Leaf as whole, and it keeps weight evenly distributed over all four wheels. Most importantly, the batteries take virtually no volume from the conventional cabin space.

Those batteries are packaged in a swoopy five-door reminiscent of the Versa, only prettier and more aero smooth. Leafs already shown by Nissan have been very close to production trim, with a smartly designed interior centered on a Scandinavian-looking stack of touch switches. The Leaf has slightly more interior volume than the Versa, with comfortable room for four adults. The trunk area dips deep behind the batteries, so there's plenty of room for gear even when the folding rear seat is occupied.

The Leaf is powered by a synchronous AC motor delivering about 107 horsepower (80 kW) and 206 pound-feet of torque through a single-gear transmission to the front wheels. We took a short drive in one of Nissan's test cars on a closed track, and were pleasantly surprised with the results. The Leaf responds immediately to movement on the power pedal, with stimulating, steady acceleration up to a top speed of about 90 miles per hour. It's smooth beyond compact-car expectations, and quiet, as one might guess.

The Leaf charges from a fully depleted state in 16 hours on standard 110-volt home current, according to Nissan engineers. With 220 current (like the typical electric dryer), it charges in eight hours. Nissan has also developed a DC quick charge station for fleet and public use that fills the batteries to 80 percent capacity in 30 minutes.

Every Leaf will be equipped with a navigation system and vehicle-specific information exchange software. With one button, the navigation map shows the radius of the Leaf's range according to the current charge level. The driver can enter a specific destination, and the system will calculate whether there's sufficient juice remaining to reach it. The map will also show known public charging stations, as it might show gas stations in a conventional car, as more public charging stations come on line.

A Leaf owner can program charging time in his or her garage to take advantage of off-peak rates. The owner can also program the climate-control system to start operating while the Leaf is plugged in, saving the battery for travel. These and other operations, such as checking the state of the Leaf's charge, can be accomplished remotely with a cell phone.

Nissan is still a bit vague about its rollout plan for the Leaf, if it is indeed called the Leaf when it goes on sale in the United States. The company says the car should be available for fleet customers in the second half of 2010, with general retail sales in key markets like California shortly thereafter. Nissan's next generation of Li-ion batteries, which may double the car's range, according to the company, could be ready by 2012, when the Leaf should be available at dealerships nationwide.

An educated guess puts the retail price between \$24,000 and \$30,000. The batteries alone currently cost \$10,000 to manufacture, according to one Nissan engineer. At the retail level, the battery pack will likely be leased to the Leaf buyer, so its cost won't necessarily be reflected in the car's price.

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