NISSAN MOTOR CORPORATION

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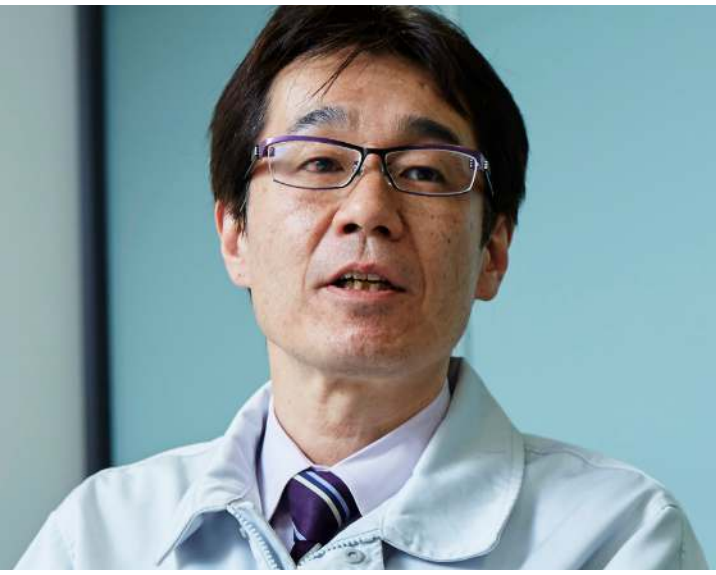
This is a translation of the Japanese newsletter. Some figures and facts related only to the Japanese market.

EVolution 2016

EV News, Trends & Technology

First to the EV future. EVolution is a monthly report from Nissan covering the latest EV news from around the world.
Each issue has a unique theme that gives insights into the growing popularity of EVs and next-generation technologies on the horizon.
This first issue includes an interview with the developer of Nissan LEAF's new 30 kWh battery,
a technological advance that extends driving range up to 280 km.
We hope you enjoy this discussion on current and future prospects for battery development,
the key issue for expanding the EV market.



Nissan batteries are the world standard for safety. Now we have boosted capacity to 30 kWh and improved endurance.

Norihiko Hirata
Deputy General Manager
Battery System Engineering Group
EV and HEV Battery Engineering Department
EV and HEV Engineering Division

Q: What gives Nissan's EV batteries such an edge in today's competitive market?

In 1992 Nissan got a head start by embarking on lithium-ion battery development.

We anticipated that lithium-ion batteries, due to their high-energy density, would work best for powering automobiles. Our research led us to develop an original laminated-type cell structure, which has several advantages. It is relatively inexpensive, has a simple structure with fewer working parts, is lightweight and thin, and can be easily designed to fit the shape of the car. Battery development takes a lot of time, requiring experimentation and testing. Since we were ahead of the game in lithium-ion battery development, we have accumulated more data, and that's why we were first to market with a 30 kWh battery.

Battery cell

200,000 EVs sold worldwide. Zero accidents due to battery problems.

Because EV batteries compactly store a huge amount of energy, safeguards in case of accident are critical. At Nissan we divide EV safety into three categories—mechanical, electrical and thermal—and we examine all kinds of driving situations and the type of accidents that could occur in each. We undertake R&D to ensure safety in each category. For example, we conduct stringent tests to learn how well a battery withstands shock from a collision, what it takes to keep a battery from overheating, and if heat is generated whether our safeguards will prevent the battery from igniting. As the result of ongoing R&D based on accumulated test data, we can proudly say that after five years and more than 200,000 units sold worldwide, Nissan LEAF has never had an accident due to a battery problem.

Battery pack drop test

Module battery crush test

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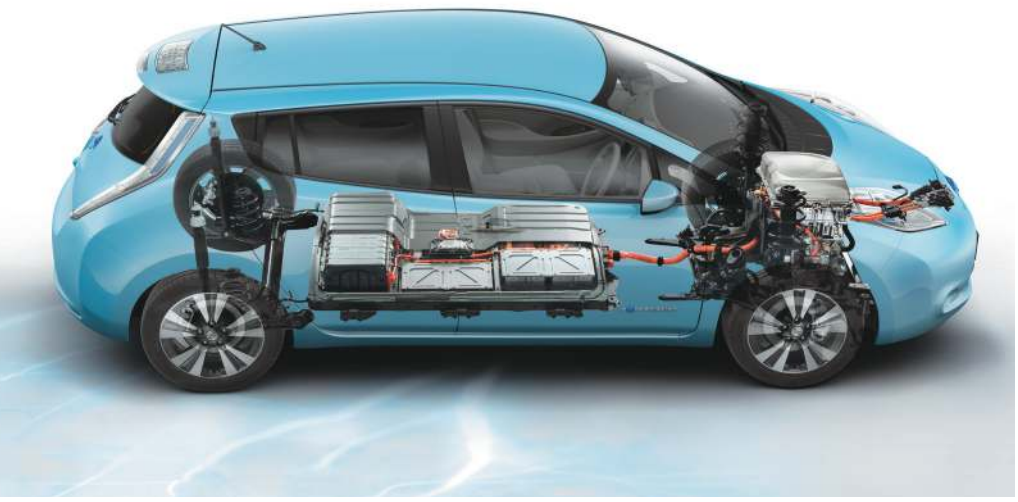
Q: Please explain some of the advances provided by this new 30 kWh battery.

Big increase in driving range to **280 km*** on one charge.

With 25% more storage capacity than our previous largest 24 kWh, this new battery extends driving range on a full charge to around 280 km (174 miles).Yet despite the higher capacity, it only takes about 30 minutes to rapid-charge the battery to 80% capacity. That would give you about 200 km (124 miles)of driving distance. This higher capacity greatly expands the range of activities drivers can plan for.

*JC08 mode



Guaranteed **160,000 km** over **8 years.***

EV batteries face heavy load demands due to the huge amount of energy they transfer when used and recharged. This is why technology must continually advance for optimal performance and safety. In developing our new 30 kWh battery, we reevaluated the materials used inside the cell to improve durability. As a result, we were able to extend our guarantee from 100,000 km (62,137 miles) over five years to 160,000 km (99,419 miles) over eight years.

*The gurarantee varies depending on the country.

More electricity storage capacity makes a significant home power supply.

Batteries designed to power automobiles have the capacity and durability to serve as power supplies for homes, too. The increase in storage capacity to 30 kWh makes significantly more electricity available.

Q: In the five years since LEAF was launched, battery capacity has risen to 30 kWh. What developments might we expect to see in the near future?

600 km* range on **1 charge** is no fantasy.

We know of many materials that have the potential to advance lithium-ion battery performance. Nissan is conducting R&D on materials that we think will increase capacity and reduce internal resistance, which will shorten charging time. Our goal is to achieve driving range of 600 km* on one rapid charge—performance that exceeds the range of a typical compact car on one tank of fuel. This is a point where EV performance may trigger a dramatic transformation in the role of cars in society. It has taken Nissan just five years to bring a 30 kWh battery to market. This fact, I think, suggests that EV evolution will occur much faster than many people expect.

*JC08 mode

Optimal power output equivalent to **280 horsepower.**

30 kWh is the unit of electrical energy the battery stores. It's peak power output is 200 kW, or approximately 280 horsepower. This puts Nissan LEAF in the same category as elite sports cars. Although energy efficiency is a key appeal of EVs, drivers also care about power output—for instance, the car's acceleration from 0 – 100km/h (60 mph). Instantaneous power output is hindered by internal battery resistance, which we are working to resolve. Technologies we develop to resolve this issue may end up being applied not only to EVs but also to hybrids, plug-in hybrids and others.

Everyday drivers will discover a big advantage in the lower running costs of EVs.

Nissan LEAF, which was first marketed in Japan and the U.S., is now available in 47 markets worldwide. From the very earliest development stage, we examined the lifestyles of people around the world and aimed to build a car that would meet real-life needs. For example, we assumed a typical customer living in California would commute to work and drive daily for lunch and take care of errands. On weekends the whole family embarks on trips together to the suburbs. Assuming the availability of basic charging infrastructure, the person who drives up to around 80 km (50 miles) a day would enjoy a full life of car ownership and never spend money on gas. With this kind of lifestyle in mind, Nissan is bringing the benefits of EVs to more and more people around the world.