How is Nissan harnessing motorsport for mainstream electric cars?

Nissan's Global Motorsports Director and e.Dams Formula E-Driver discuss how cutting-edge technology could benefit passenger cars. By Elle Farrell-Kingsley

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Motorsports teams invest billions into developing new technologies to give their team the winning edge on the track. It's not surprising, then, that manufacturers want to see some return on their investment by domesticating their innovations and turning them into technology applied to the passenger car.

One way innovation influences mainstream electric cars is through Formula E, motorsport's answer to a greener race, using 100% recycled materials and electric batteries. All Formula E open-wheel race cars are powered by the same batteries, electric motor, and chassis. McLaren Electronic Systems supplied the engine in its first Gen car in the opening season. Having the same specifications in its race cars means teams come together to pioneer the latest and most efficient electric vehicle (EV). Gen3 is the latest innovation, making its debut in the 22/23 season. Following further intensive development testing, both on and off the track, a series of design, performance, and sustainability innovations in the Gen3 car have been announced. Formula-E claims it will be the world's "most efficient racing car", with at least 40% of its energy produced by regenerative braking instead of fuel like Formula One, Two and Three.

The Gen3 formula car features an electric motor capable of delivering up to 350kW of power (470bhp), a top speed of 200mph (320 kph), and a power-to-weight ratio that is twice as efficient as an equivalent 470bhp internal combustion engine (ICE). In addition to this rear powertrain, it also features one at the front that adds 250kW–almost doubling the Gen2's current regenerative capability to a 600kW. Because of these additions, the car will not feature hydraulic brakes at the rear, although it will retain them at the front. Japanese automaker Nissan has partnered with Shell to help pioneer new electrification technology.

Maximilian Günther,
Shell and Nissan e.dams driver

Tommaso Volpe,
Nissan Global Motorsport Director

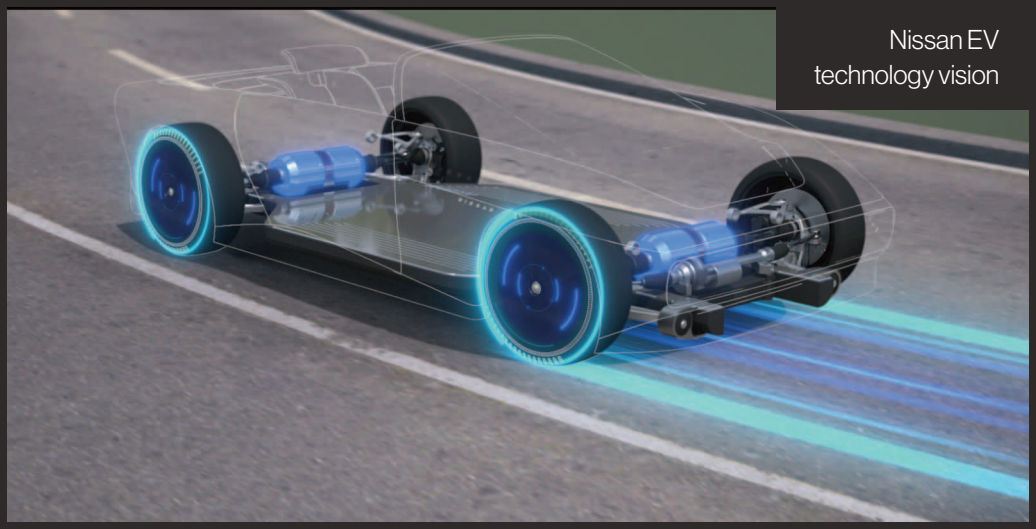
Shell and Nissan e.dams driver Maximilian Günther (MG) and Nissan Global Motorsport Director Tommaso Volpe (TV) talk to *Automotive World* about Nissan's participation in Formula-E, how the vehicles work, and, most importantly, how this technology can be utilised for road-going vehicles. German racer Günther joined Nissan e.dams ahead of Season 8 of the ABB FIA Formula E World Championship. Making his Formula E debut at 21, he became the youngest race winner in Formula E history when he claimed victory at the Santiago E-Prix in Season 6.

What brought Nissan to Formula-E?

TV: We joined Formula-E because Nissan is competing and pioneering in electrification. Some years ago, we were the first brand to launch a mass-produced EV. We have been a bit shy in promoting it, but we launched an EV before anyone else on the market.

Also, we have a firm commitment to the future: by 2030, all of Nissan's models will be electric, and by 2050 we will be 100% carbon neutral. Formula E is perfectly aligned as a platform in both areas. Of course, electrification is the most important aspect of electric motorsport, but it's also a carbon-neutral sport. That allows us to promote these two vital elements of our strategy for passenger cars.

But the important thing is that our involvement is also from a genuine technical perspective. For the Gen3 we developed the powertrain directly, with the involvement of advanced R&D from the labs in Japan on the innovative inverter, gearbox, and motor.



Nissan EV technology vision

Is 'all-electric by 2030' a goal that Nissan has set globally?

TV: Yes, in all the key markets: Europe, the UK, North America, China, and Japan. Other markets will depend on local regulations. One limitation is that we don't know the state of the supporting infrastructure for EVs in other markets, which doesn't necessarily depend on Nissan. That's why our commitment is to the key markets first.

As a race car driver, what are your personal highlights from using this technology?

MG: The Formula E cars are now the most modern race car you can drive. I have been racing Gen2 Formula E cars for four years with other teams and joined the Nissan team in 2022. The challenges with the vehicle are enormous because racing always takes place on street circuits. It's very tight, narrow and bumpy.

> "In a couple of years–two to three–you will see the effect of these developments

It's critical for drivers to maximise the car's braking system performance. At the front, there are standard brakes and carbon brakes, but the car's rear section can make the most difference with the control systems, the whole electric motor, and the regen. The control systems and regen work as energy recovery mechanisms and assist with energy conservation. Driving becomes very different during the race because you must prioritise efficiency and energy conservation. Before each lap, you push a regen button to recharge the battery, so it doesn't run out.

How does the battery impact the car?

MG: The battery has 52kWh, which isn't enough energy to finish the race if you go full force every lap. You need to save some energy by coasting for the early laps instead of going full speed. This way, you distribute the energy throughout the race.

This opens up different strategies and tactics. You can be more aggressive at the beginning of the race, consuming more energy, but still being mindful of saving some for the end. Or you can do it the other way around. But, when you cross the finish line, you're always on zero. You just run out of energy before the line. This is the goal–to be the most efficient in the race.

Which elements of Gen3's innovations might influence passenger car systems?

TV: From the manufacturer's perspective, these are the two key performance differentiators: efficiency and energy management. In both areas, we learn how to improve our EVs for the future on the track. That's because it's crucial to have an efficient powertrain and very sophisticated energy management in passenger cars, too.

There are two main areas where Nissan and Shell transfer the R&D findings from race cars to passenger cars. One is the efficiency of the hardware–the motor, the inverter and the gearbox. This is about optimising their efficiency, not just the design but also aspects such as the materials we use.

In Formula E, the energy efficiency of the powertrain is in excess of 95%. From this, we can learn a lot about how

Nissan's COO Ashwani Gupta with the Gen3 model

to reach much higher efficiency in the powertrain we employ for street use.

The other main area is energy management because, as Max said, it's an energy race. They all have the same power output. Despite the powertrains being different from one team to another, all the cars feature a spec 54kWh battery, and power is capped at 250kW by regulation. Ultimately, winning a race depends on how well the energy can be managed. As such, the software and tools used to regulate energy are the other crucial elements.

Furthermore, because it's software, it can be programmed. We can then apply the same codes to a standard car. Through effective energy management, we can extend the range of our passenger cars and that's the real benefit for consumers.

What went into developing the Gen3 car, and when might this technology trickle down into the mass market?

TV: The Gen2 was developed and launched in 2018. We took Nissan's 70 years of experience in the mass-produced vehicle market, as well as knowledge gained from EV prototypes, and transformed it into a race car. For Gen3, we did the opposite—we took what we learned about race car energy management and put it into the Nissan Leaf—our passenger EV.

We started developing the Gen3 car in 2021, with senior engineers from Japan and France working on it. These engineers are already transferring the innovations from this project to vehicles outside of motorsports. So, in a couple of years—two to three—you will see the effect of these developments.