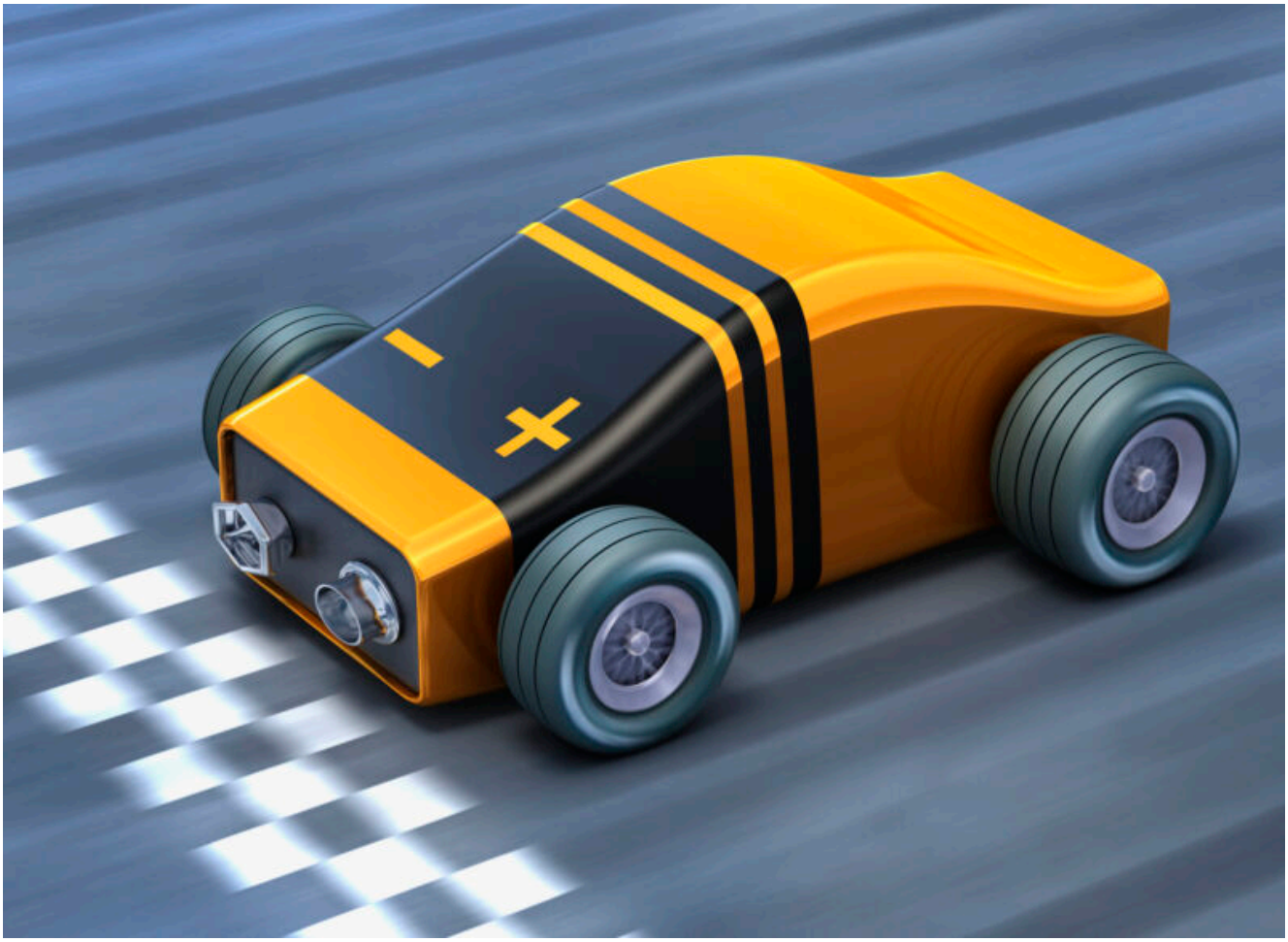
Disappointed by Formula E’s plan for its next car? Here’s an alternative



Enlarge / The future Formula E car will look almost nothing like this.
Matthias Kulka/Getty Images

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Formula E only adopted its second-generation electric race car at the beginning of last season, but the motorsport is finalizing plans for the next iteration—called Gen3—set to

debut in season nine (2022/2023). The plan is to make the car more powerful and lighter, with more ability to regenerate energy under braking. It will even adopt mid-race fast-charging. All of that is an improvement on the Gen2 car, but here at Ars, we can't help but feel that Formula E is missing an opportunity to be bolder. And we're not alone. Lucas di Grassi—season 3's champion—has his own idea for the direction Gen3 should take, and it's one the EV crowd will probably like.

Formula E's plan

Formula E's plan for the Gen3 car is evolutionary rather than revolutionary. Power is going up, with 350kW (469hp) available in qualifying, compared to the current 250kW (335hp), which will put speeds somewhere between Formula 3 and Formula 2. (Power output during the 45-minute races is capped at 300kW/402hp.) The battery is going to get considerably lighter, weighing 397lbs (180kg) compared to the current 547lbs (248kg), albeit with a slight reduction in capacity to 51kWh.

The battery will be able to charge at 600kW, more than twice the power of even the best EVs on sale today. That will enable mid-race fast charging, which will add 4kWh in 30 seconds. And the cars will be able to regenerate energy under deceleration at the same power level, thanks to a front-axle 250kW generator unit that works in conjunction with the 350kW motor-generator unit (MGU). However, the front wheels will only regenerate energy—there's no plan to allow the cars to deploy power to the front wheels, unlike just about every high-performance electric road car on sale or in development.

The di Grassi plan

The way the rules are shaping up means that teams will have to develop their own rear MGU, but that front generator unit will

be produced by a single supplier.

“What I don’t really understand is that some key features that could be commercially relevant—and you need the R&D to be there—are kind of used as an excuse to have cost-cutting measures,” di Grassi told me when we spoke recently. “If you have an MGU in the front, it makes no sense not to use it to power the car.”

One of the chief complaints leveled at Formula E has been that the cars aren’t fast enough. While that’s less of an issue now with the Gen2 car, di Grassi still thinks there’s room to improve. “I want Formula E cars to be very impressive in acceleration, which electric cars are good at. Any electric car that costs $100,000 in two or three years time will accelerate zero to 100km/h (62mph) faster than Formula E because it’s four-wheel drive. My vision is that zero to 200km/h (125mph)—Formula E needs to be equivalent to Formula 1,” he said.

If it were up to di Grassi, the Gen3 car would use identical front and rear MGUs, both at the current output of 250kW (335hp). The cars would be able to regen and deploy that power at both axles.

“I did the calculations,” he told me. “And with a 55-45 weight distribution front to rear and 500kW (670hp) of power, with the current weight, we would accelerate to 200 very close to Formula 1. For me, that would be amazing.” (Indeed, the 500kW Volkswagen ID R suggests he’s entirely right, given how quickly it accelerates.)

“The teams have already developed a very, very efficient and very good powertrain for seasons seven and eight. Why not use the same powertrain and then just produce one more [for each car] and then put it on the front axle, instead of producing a brand new one with 350kW? So my proposal was at least to try to use the technology that’s already been developed,” he

explained.

> *#Gen3 #FIAFormulaE should be:*
> *– front + rear symmetrical 250kw MGU with common std differential;*
> *– 4 wheel power & regen modular;*
> *– No mech brakes;*
> *– floor battery ~50kwh 10C in/out with fast charging;*
> *– movable aerodynamics & std/common electronic kinematics software controlled*
>
> *– LUCAS DI GRASSI (@LucasdiGrassi) July 4, 2020*

But he wouldn't allow the cars to use both MGUs at full power at every event. "For example, Paris cannot do 500kW," he explained, referring to the tight street-circuit layout used in the French city. "Then you cut the front axle out; you say, 'Look, at Paris, only the rear axle, 250kW, like we have today.' And then you go to Mexico, a grade 1 circuit: 500kW in qualifying."

"I mean, could be any race, you come up with different power," he went on. "It's even nice to mix the grid up because maybe a team has a better setup for rear axle, the other has a better setup for four-wheel drive. So you could come up with different kind of rules [that] will not put a pressure on the promoter, because if you make 350kW standard, the cost to make a racing track in Paris will double because you need runoff areas which are twice as long. You need to resurface everything to be super flat. We cannot race in Hong Kong, we cannot race in Paris with 350kW. It needs to be modular so we can keep racing the tracks that we race, and at the tracks that we can increase power, we'll increase power."

Active aero, common dampers

Another thing di Grassi would like to see is the adoption of a

common damper across all the teams.

“The amount of money we spend on them, just because dampers are free [in the rules], is ridiculous,” he said. “We take the car to seven-post rigs, we put the car there, we say every single track has a different damper, and so on. So it’s a lot of cost. A lot of things that shouldn’t be free should be controlled, and then use the money saved in these areas to make it more relevant.”

That would include electronically controlled suspension, something that is almost universally banned in racing yet is commonplace in modern cars. “This is actually super cheap to produce today, but just because they banned it in F1 [in 1993] because it was dangerous has nothing to do with Formula E now,” di Grassi explained. “For example, having an electronically controlled anti-roll bar is super simple to do. You take one solenoid that changes the bar and it has a huge effect.”

Solenoids would also power active aerodynamics—another area where road cars have long left the racing world behind. This could add to the spectacle of the races, with cars testing their movable flaps on the grid in the same way pilots check that their movable flaps and rudders work before taking off.

Standard diffs and a skateboard layout

Production EVs rarely have differentials, but they do in Formula E. “And because the differential is so important in Formula E, we spend a lot of money in research and development making a special differential,” di Grassi told me. “I think it should be a common part because this is very relevant to performance, and it has a huge cost.”

His plan for the battery design is also more road-relevant

than the current Gen3 plan by using a skateboard layout, with batteries in the floor of the car between the axles. Formula E's plan for the Gen3 machine, like the Gen1 and Gen2 cars (as well as the VW ID. R) basically just shoehorns a battery pack into a chassis that's pretty similar to the single-seaters powered by internal combustion engines. (This would make the powertrain layout similar to Roborace's car, which uses a symmetrical layout as described.)

"I truly believe that the electric cars and electric racing cars have to be an inherently different design from a combustion engine. And at the moment, what the FIA is doing is designing a conventional race car and exchanging the internal combustion engine for the electric motor and the battery, almost like 10 years ago; when people did the first electric cars, they took the engine out and they put the electric motor in, they put the battery in the boot [trunk], and they said that was an electric car. Then other manufacturers came and made the battery on the floor," he pointed out.

No mechanical brakes would make for better racing

The current Gen3 plan calls for no mechanical brakes at the rear axle, but di Grassi would go further. He would remove friction brakes altogether. Well, sort of.

"Actually, I would put a special mechanical brake in the diff as a safety device," he told Ars. "When I said no mechanical brakes, I could not really write on Twitter exactly what I meant. But I would put a single very thin disc in both differentials, almost like a hydraulic lock. So if the battery fails [and you can't regen], it basically locks both diffs, and the car just stops."

He also thinks the car could use a supercapacitor that would be able to store energy at the beginning of the race when the

battery pack is at 100 percent state of charge. He suggests that if his ideas were implemented, it would actually improve the racing.

“Fine, you lose a little bit of performance, because you’re not going to be able to brake so late because the car can’t take more than 500kW at high speeds,” di Grassi explained. “But, I mean, you need to do something new. Actually, it goes in the direction that people love, which is increasing the braking distance. One way to increase the brake distance is actually limiting the braking power. If you don’t have mechanical brakes, everybody breaks earlier. So, actually, the overtakes become even better in this case.”

I don’t know about you, but I think he’s on to something.

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