News

Electric Motorbikes Putting Power & Performance to the Test

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Timothy Gotsick is the Vice President of Technology and Innovation at MacDermid Enthone Industrial Solutions, a company which works with EV engineers to increase the electrical and thermal efficiency of cars by offering low resistance coatings to manage the temperature of all operating components. This enables the use of lighter parts by better protecting them from the environment. He is particularly passionate about solving the issue of range anxiety, which is a fear for all electric drivers. Timothy suggests that range anxiety can be resolved by giving BEVs more range and making them easier to recharge.

“Adding more range to a Battery Electric Vehicle means increasing the batteries — which adds cost and weight — or more electrical efficiency,” he tells *EV Magazine*. “Improved efficiency not only increases range, but can also attack buyers' inherent cost concerns.”

Timothy is also fascinated by electric motorcycle technology, a field which receives less interest than electric cars. But with up to 600m motorbikes on the road, compared to the 1.4bn cars, it’s an expanding topic of interest for vehicle manufacturers.

The evolution of electric motorcycles

According to Timothy, the ultimate performance stage is the racetrack and the summit for motorcycles is MotoGP.

“MotoGP bikes are the two-wheeled equivalent of F1 cars — purpose-built race vehicles engineered for maximum performance on closed courses,” he says. “As such, they are the best benchmark of performance.

MotoE is the companion series to MotoGP for electric motorcycles. Started in 2019, the series runs on spec bikes where all racers ride the same model supplied from 2019 to 2022 by Energica and in 2023 by Ducati. Comparative numbers in the table below help to illuminate trends.

The first thing to notice is the large difference in weight between MotoGP and MotoE.

“This is largely due to the batteries required for the MotoE bike, an 18kWh pack weighing 110kg,” Timothy explains. “Even with this battery pack, the MotoE series

can typically run only eight lap races, compared to 22 for MotoGP bikes with a fuel capacity of 22 litres.”

This is a result of the much higher energy density of liquid fuels and the extra weight impacting both the acceleration and cornering speed of the MotoE bike.

Timothy highlights that the power numbers are also noteworthy, as they showcase how high the output of modern IC engines can be — the MotoGP bikes make an estimated 250hp from their 1000cc engines. In contrast, the MotoE bike makes around 150hp.

“As someone who owns a 150hp motorcycle — a Yamaha FJ1300 — I know firsthand that this is a staggering amount of motive force to have at one’s command,” Timothy says. “This power output cannot be safely or effectively exploited on the street, and that even on the track requires skill and experience possessed by few riders.”

The higher weight and lower power of the MotoE bike make it slower in both acceleration and top speed when compared to the MotoGP bike. Although according to Timothy, most motorbike owners would deem the MotoE bike as blindingly fast, the stopwatch shows that the MotoE bike is significantly slower than a MotoGP equivalent at 9 seconds/lap.

“The culprit for this speed disparity isn’t the electric motor,” Timothy explains “There are plenty of 300hp electric motors available. The real issue for electric motorcycles is the energy density of batteries..

Given the huge difference in energy density between modern lithium-ion batteries (200-250 Wh/kg) and gasoline (13,000 Wh/kg), ample power can be produced by a small IC engine and a little liquid fuel, which keeps the weight of the vehicle low.

“Given that the *raison d’etre* of a motorcycle is lightweight, it is no surprise that even the most advanced electric motorcycles are inferior to their gasoline-powered forebears in ultimate performance,” Timothy continues. “That 250hp MotoGP bike races for 50 miles on 36lbs of fuel, while the 150hp MotoE needs 220 lbs of batteries to go 20 miles at racing speed. My FJR’s spot in the garage seems secure for a few more years.”

The future of electric motorcycles

Timothy is adamant that there is more than just a glimmer of hope for the future of electric motorcycles, as the data shows that one of the biggest reasons to be bullish on electric vehicle technology is that electric motorcycles are improving far faster than their IC brethren, in nearly every performance dimension year-over-year.

Parameter	**MotoGP**	**MotoE (3)**
Weight, kg / lbs	157 / 346	225 / 496
Est. power, hp	250	150
0-100 km/h, s	2.3	2.9
Top speed, km/h, mph (Assen)	310 / 192	247 / 154
Pole lap time (Assen)	1:31.472	1:40.743
Pole time diff, 2022-2023, s	0.032	2.9

“As the last row in the table shows, the 2023 MotoE pole lap time was 2.9 seconds lower than the previous year at the same track, but the MotoGP pole lap time was almost unchanged — only 0.032 second lower,” Timothy explains.

In the racing world, 2.9 seconds per lap is an *enormous* improvement and it illustrates electric vehicle technology is on a far steeper upward curve than IC technology, which is relatively mature.

Yet Timothy warns that forecasting the future is a notoriously tricky venture —- but there are good reasons for optimism in the electric vehicle world.

“Over the past 30 years, battery energy density has increased by 400%, while costs/kWh have fallen by 99%. Gasoline energy density is unchanged over the same period and its inflation-adjusted cost in the US is virtually identical,” he finishes. “The IC standard is very high, but it’s not moving.”

Timothy’s FJR may have reason to be nervous soon.

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