

How HORIBA Helps Vehicle Manufacturers and Developers Electrify and Meet Regulations

Upcoming green house gas regulations have created an industry-wide race to compliance. Corporate Average Fuel Economy (CAFE) standards, CARB's Zero Emission Vehicle production requirements, China 6 regulation, and the European Commission's fuel economy standards are all part of an overwhelming web of standards forcing the entire industry to vehicle electrification. Testament to this is the significant growth in the number of models offered that are hybrid or all electric as reported in figure 1 by The Alternative Fuels Data Center in the U.S. Department of Energy.

Charging ahead in support of electrification and intelligent mobility is GM with its bold "zero" initiative. "Today, we are calling for a National Zero Emission Vehicle program ... to help move our country faster to an all-electric, zero emissions future," said Mary Barra, CEO of General Motors in her recent op-ed in *USA Today*. It seems that all the OEMs are talking about their version of an electrified future, including Mazda who stated in *Automotive Engineering* Nov/Dec. 2018 issue, "All vehicles will have some type of electrification by 2030 and 30 percent will be fully electric." BMW has also embraced electrification with its "i" family of vehicles. Not to mention Ford's "Smart Mobility" and the company's mission to use technology and innovation to address mobility trends and make people's lives better. While details of the OEM's visions may vary, all agree on one thing: The future of mobility is undoubtedly electric.

With advanced measurement and engineering technologies and over 70 years of expertise, HORIBA is helping to pave the road electric vehicle manufacturers and developers must travel. The HORIBA electric vehicle application

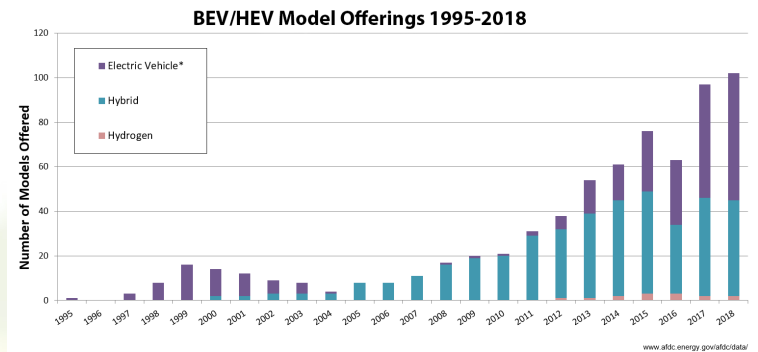


Figure 1 - EVs include plug-in HEVs, but does not include Neighborhood Electric Vehicles, Low Speed Electric Vehicles, or two-wheeled electric vehicles. Only full-sized vehicles sold in the U.S. and capable of 60mph are listed.

"Today, we are calling for a National Zero Emission Vehicle program ... to help move our country faster to an all-electric, zero emissions future."

**- Mary Barra,
CEO of General Motors**

HORIBA

Making The World

CLEANER And More
EFFICIENT

portfolio includes a range of products and services in key industry focus areas including verification and validation of high-speed e-motors, battery packs, fuel cells, subsequent control strategies, and thermal management.

HORIBA's forward-thinking electric vehicle R&D application set features its TITAN E test platform composed of TITAN ePowertrain, TITAN eDrive and TITAN eBattery. This series, and its modular approach, promises to “future-proof” test equipment allowing varying degrees

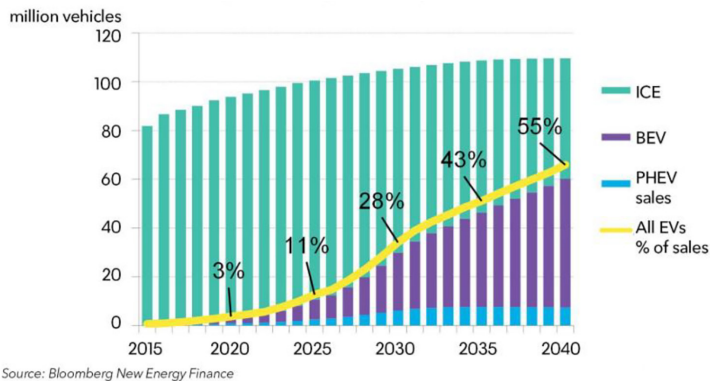


Figure 2 - The OEM offering is changing to address these regulations and predictions indicate that nearly 55 percent of vehicles sold will have electrification by 2040. Statements the major global OEMs have made within the press over the last year further support the data in figure 2.

of electrification within multiple powertrain configurations. TITAN ePowertrain helps manufacturers and developers validate their designs and test to meet durability, NVH, environmental, regulatory, and calibration design goals.

“HORIBA has spent years developing the necessary expertise to make us a complete solution provider for electric vehicle manufacturers and developers,” said Rick Rooney, director of product marketing at HORIBA. “The demand to increase electric vehicle development capability will grow as the industry continues to meet consumer, environmental, and regulatory demands. To accomplish this, electric vehicle and sub-system developers will need advanced R&D tools, intelligent software, and robust test systems that produce accurate, reliable, repeatable data. Our expertise lies in successfully bringing together this

The proverbial “secret sauce” for HORIBA’s overall electric vehicle solution lies in the software throughout its technologies.

complex mesh of information, and that is what makes us the complete solutions provider for electric vehicle manufacturers and developers.”

The proverbial “secret sauce” for HORIBA’s overall electric vehicle solution lies in the software throughout its technologies. For example, HORIBA accelerates electric vehicle R&D by pairing its Virtual Battery emulation tool with its TrueData Series software, used in battery and fuel cell R&D, to accurately determine state of charge and state of life. In tandem, they are able to produce dynamic performance profiles for use in powertrain testing while the actual battery is still under development. The TrueData Series is just one part of a full range of test systems for fuel cells and batteries, including end-of-line testing. The STARS Test Automation system sits on top of the entire testing process, gathering data from simulation tools, electronic control units, and hardware in the loop (HIL) in the test cell. STARS then uses this data to inform testing protocols and streamline results.

Nowhere are HORIBA's R&D electric vehicle capabilities more apparent than through the people and services that form its engineering consultancy and test services. HORIBA MIRA's operations are home to a wealth of technical expertise actively charting the horizon of vehicle electrification. Electric vehicle power sources, e-motors, and sub-system components are only as good as their

“Our expertise lies in successfully bringing together this complex mesh of information, and that is what makes us the complete solutions provider for electric vehicle manufacturers and developers.”

-Rick Rooney, Director of Product Marketing, HORIBA

ability to communicate with each other. HORIBA MIRA has helped countless electric vehicle-focused OEMs and tier suppliers make their products and processes more efficient.

HORIBA also supports fundamental fuel cell and battery product development based on a long history of pioneering in the field of spectroscopy. One example is the XploRA™ Raman Microscope used for structural analysis and in-operando evaluation of battery anodes and cathodes during charge/discharge cycles, which helps evaluate materials that ensure battery integrity. The Partica LA-960V2 provides the particle size distribution of materials that form the anode and cathode of a battery as they can greatly influence performance characteristics. In addition, the GD-Profiler2™ is for elemental depth profiling of battery films and diffusion studies using a radio-frequency glow discharge system.

As OEMs try to balance regulatory compliance, customer preference, and sustainable profits, the industry faces a myriad of challenges. HORIBA helps electric vehicle manufacturers and developers implement robust test bed solutions, quantify component performance, and speed development using a complete lifecycle of simulation for HIL. HORIBA also has a full range of products for certifying components and whole vehicles to regulatory standards. HORIBA focuses on the big picture to solve the big challenges of electric vehicle engineering.

ABOUT HORIBA

A business segment of the HORIBA Group, Automotive Test Systems (ATS) has developed global leadership in the fields of battery and fuel cell test stands, data management solutions, driveline test systems, engine test systems, brake test systems, wind tunnel balances, emissions test systems and test facility automation. HORIBA ATS is able to offer its customers complete solutions with full turnkey capability for all industries using electric motors, internal combustion engines and turbines. These include the automotive, heavy-duty, off-road, consumer goods, marine, aerospace and locomotive sectors.



HORIBA