



Ansys

**ENVIRONMENTAL
SUSTAINABILITY IN FOCUS**

**/ SIMULATION PRODUCT HANDPRINT:
ELECTRIC VEHICLES**

Ansys is the global leader in engineering simulation software and services widely used by engineers, designers, researchers and students across a broad spectrum of industries and academia, including aerospace and defense, automotive, electronics, semiconductors, energy, materials and chemical processing, turbomachinery, consumer products, healthcare and sports.

Engineering simulation is the application of physics-based software solutions across the product lifecycle from ideation, to design, manufacturing and operation, enabling engineers to virtually test operational performance and predict how product designs will behave in real-world environments. Applying engineering simulation solutions significantly reduces cost, shortens time to market and reduces risk of failure by improving product quality.

Ansys is committed to the conservation and sustainability of the planet's resources by operating our business in ways that reduce our environmental impact and carbon footprint. We also encourage and support our stakeholders, including our vendors and customers, to do the same. As part of Ansys' environmental sustainability efforts, we made our first **CDP submission** in 2020 and are committed to taking steps to measure and mitigate the carbon footprint of our operations.

As the global leader in simulation software, Ansys is well positioned to also provide technology solutions that support and enable the sustainability goals of our customers across diverse industries. **Our solutions have a positive impact on the environment by helping our customers** to reduce their use of resources while increasing their efficiency and productivity. Discovering and implementing efficient means of innovative product design and operation — with minimal use of physical resources — is at the very heart of our vision of pervasive simulation.

While measuring and reducing our own environmental impact is essential, the benefits from this process are finite. By contrast, our **product handprint** — the use of simulation by customers to reduce their own carbon footprint and the footprint of their products — is nearly infinite.

Here we present one in a series of use cases illustrating how Ansys simulation creates these handprint benefits.



USE CASE / ELECTRIC VEHICLES

Reducing Emissions, Improving Efficiency and Driving Down Cost

Traditional internal combustion engines (ICEs) are a significant contributor to global carbon emissions. Road transportation contributed approximately 5 gigatonnes of carbon emissions in 2016.^[1] According to an Ansys-commissioned study by Evalueserve, electric vehicles (EVs) currently emit 63% fewer carbon emissions than their ICE counterparts throughout their lifecycle, and by 2030, Evalueserve projects this will be closer to 75% due to the technological advancements of EVs. According to the study, widespread market adoption of EVs coupled with technological developments over time could result in a carbon emission reduction of 2050 to 2500 million tonnes cumulatively by 2030.^[2] This is the equivalent of taking around 350 million ICE vehicles off the road. Through 2030, the EV market is predicted to grow nearly 30% annually.^[3]

Grand Challenges to Widespread EV Adoption

- **Cost Reduction:** The battery system alone contributes ~40-50% of the total electric vehicle cost.^[4] An EV costs on average approximately \$10,000 more than an ICE vehicle.^[5]
- **Range & Charging Improvements:** Range anxiety, speed of charging and charging infrastructure are leading concerns for electric vehicles.
- **Performance:** Current electric drivetrains can suffer up to 20% energy loss.^[6] Delivering the EV performance that consumers and businesses demands means that every percent counts.

Simulation is the Solution to Electric Mobility's Grand Challenges

The leaders in the electric vehicle revolution are reporting significant impact in the race to market and technology advancement through simulation. The faster EV technology is brought to market, the sooner the environmental impact is realized.

Reported statistics include:

50%
REDUCTION

IN OVERALL ELECTRIC VEHICLE
DEVELOPMENT TIME^[7]

75%
REDUCTION

IN AC DRIVE DEVELOPMENT TIME^[8]

12%
IMPROVEMENT

IN POWER DENSITY AND ENERGY EFFICIENCY^[9]



Ansys Simulation Solution Applied to Four Critical Electrification Technologies

Ansys simulation solutions are used by more than 90% of the world's leading automotive suppliers. As a leading provider of simulation solutions to the industry, in addition to traditional vehicle engineering challenges such as lightweighting and aerodynamic improvements, Ansys simulation solutions for electrification are applied in four critical technology areas:

Electrified Powertrain System Integration

Ansys' multiphysics and embedded software capabilities are applied at the system level, incorporating high fidelity models of key components to optimize the powertrain system for performance, safety and cost

Power Electronics

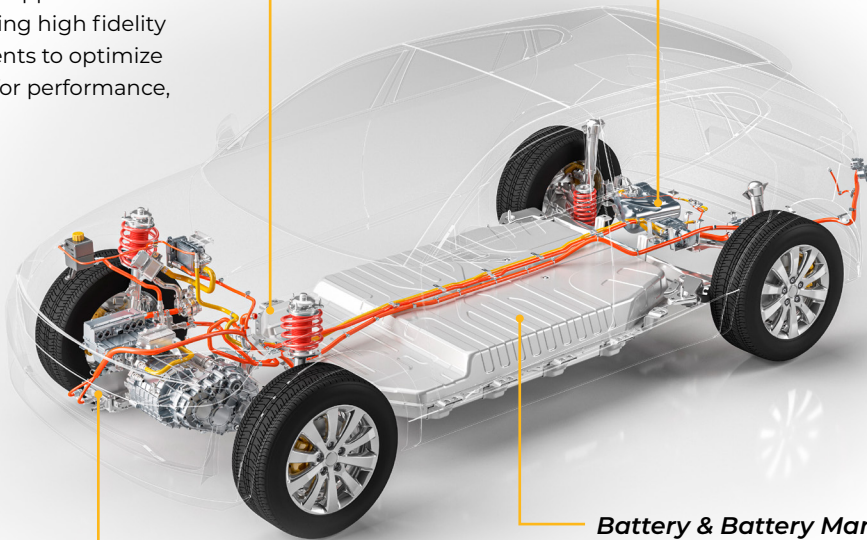
Ansys' multiphysics capabilities are used to increase power density and lifetime, while reducing losses, thermal derating, noise and over-voltages

Electric Motors

Ansys' multiphysics and embedded software capabilities are used to evaluate motor efficiency and torque speed characteristics, optimize thermal management, address noise, vibration and harshness challenges and integrate the motor design with the control system

Battery & Battery Management Systems

Ansys' multiphysics and embedded software capabilities are used to advance and optimize battery and BMS development from the electrochemistry of the cell to the safety and performance of the system



Ansys: Powering the Electrification Revolution

Ansys is the Official Technology Partner for the TAG Heuer Porsche Formula E team. We collaborate to deliver next generation technology and methodologies for the development of electric powertrain systems.

"Fully electric racing is about efficiency," says the TAG Heuer Porsche Formula E team's Head of Operations Amiel Lindsey. "We have a defined battery capacity and power output given to us by Formula E which is the same for everybody. It's up to us to be as efficient as possible to go that little bit faster compared to the competition."

Porsche Motorsport is the world's most successful and one of the world's most traditional motorsport organizations. It is also one of the very few motorsport organizations tightly coupled to series development.

"Formula E is the stage to develop and expand our outstanding competencies in the field of electric powertrains – bringing them from racetrack into series production." says Fritz Enzinger, Vice President Porsche Motorsport.

The development goals for series cars and for the Porsche 99X Electric are the very same – maximum efficiency of the Porsche E-Performance Powertrain.

Simulation solutions save raw materials and ultimately reduce our customers' carbon footprint by replacing physical testing with digital testing and accelerating time to market. But perhaps more significantly, when used as part of the design and development phase, simulation can help Ansys customers build effective and efficient products that are integral to meeting the environmental sustainability needs of the future.

We hope to bring you additional use cases illustrating our product handprint in the future. For now, please see additional information on Ansys' exciting technological innovations and corporate responsibility initiatives below.

- [1] Source: World Resources Institute (<https://www.wri.org/our-work/topics/energy>)
- [2] Ansys commissioned study conducted by Evaluateserve in 2020. Per vehicle carbon emissions of ICEs and EVs compared throughout lifecycle. Range of emission savings is based on fleet forecasts prepared by BloombergNEF and IEA Stated Policies Scenario.
- [3] Electric vehicle growth based on estimates from BloombergNEF and IEA Stated Policies Scenario.
- [4] Source: <https://www.thequint.com/tech-and-auto/change-what-you-can/the-cost-of-electric-vehicle-batteries#read-more>
- [5] Source: <https://www.mckinsey.com/-/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/The%20future%20of%20mobility%20is%20at%20our%20doorstep/The-future-of-mobility-is-at-our-doorstep.ashx>
- [6] Source: <https://www.fueleconomy.gov/feg/atv-ev.shtml#:~:text=An%20EV%20drive%20system,75%25%20for%20a%20gasoline%20engine.&text=See%20All%20Electric%20Vehicles%20for,efficient%2C%20depending%20upon%20drive%20cycle.>
- [7] <https://www.youtube.com/watch?v=GpJaVUs0UH4>
- [8] <https://www.ansys.com/-/media/ansys/corporate/resourcelibrary/casestudy/sherlock-danfoss-case-study.pdf>
- [9] <https://www.ansys.com/en-in/about-ansys/advantage-magazine/volume-xi-issue-2-2017/electrifying-vehicle>



Additional Resources:

- Porsche Fully Electric Race Car Targets Formula E Championship Using Ansys Technology
- Subaru Corporation and Ansys Power the Future of Hybrid Electric Vehicle Design
- Volkswagen Smashes Time Record at Legendary Nurburgring with Ansys Simulation Solutions
- Lucid Air and Ansys: The Full Potential of Electrification
- Leading the Electric Vehicle Charge (Ansys Advantage Magazine)
- Ansys 2019 Corporate Responsibility Report

Questions?

Please contact our corporate responsibility coordinator at:
corporateresponsibility@ansys.com.

Investor Contact

Kelsey DeBriyn
Vice President, Investor Relations

724.820.3927
kelsey.debriyn@ansys.com



ANSYS, Inc.
Southpointe
2600 Ansys Drive
Canonsburg, PA 15317
U.S.A.
724.746.3304
ansysinfo@ansys.com

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