



Ansys

**ENVIRONMENTAL
SUSTAINABILITY IN FOCUS**

**/ SIMULATION PRODUCT HANDPRINT:
AUTOMOTIVE**

Simulation Supports Sustainability

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. As part of Ansys' environmental sustainability efforts, we submit to the Carbon Disclosure Project (CDP) annually 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 can 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 and 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 research findings and a series of use cases that illustrate how Ansys simulation creates these handprint benefits.



Helping Automakers Gear Up for a Greener Future

Automakers face a huge challenge when it comes to their role in climate change. Many have pledged to produce a certain percentage of electric vehicles in a relatively short timeframe; meet net-zero goals by a certain year; increase the use of recyclable and sustainable materials; and more. With road transportation accounting for almost 20% of the carbon dioxide (CO₂) released into the environment, they play a large part in any effort to reduce global emissions.¹

Simulation can assist in many ways. By using it before building prototypes, original equipment manufacturers (OEMs) save all the emissions that prototypes generate. Simulation allows for many more design iterations, improving speed and cost, and frequently innovating with a solution that might not have been realized through traditional “build, test, fix” processes. In fact, most OEMs and suppliers use Ansys simulation for at least some of their engineering challenges.

Simulation is not just used during early product development. It can and should be deployed across the entire product life cycle. Ansys solutions in the areas of materials intelligence and model-based systems engineering (MBSE) are examples of holistic technologies to be used at every stage of the life cycle. The earlier solutions like our multiphysics solvers and design optimization tools are deployed, the more benefits they provide.

At Ansys, we have developed simulation solutions for accelerating the development of more sustainable, next-generation mobility with an emphasis on electromobility, software-defined vehicles, and assisted driving.

Simulation and Sustainability: Ansys Survey Results

Recently Ansys partnered with Digital Engineering 24/7 to commission a survey of engineering professionals, including representatives of the automotive industry. The survey asked respondents to describe the sustainability benefits their companies gain from simulation-driven product development. The following are some of the key findings, with additional insights from Ansys where appropriate.

When asked to rate the importance of sustainability to their organizations on a scale of one 1 to 10, with one being the least important, almost two-thirds (64%) of respondents rated sustainability as very important with a score of eight or above.

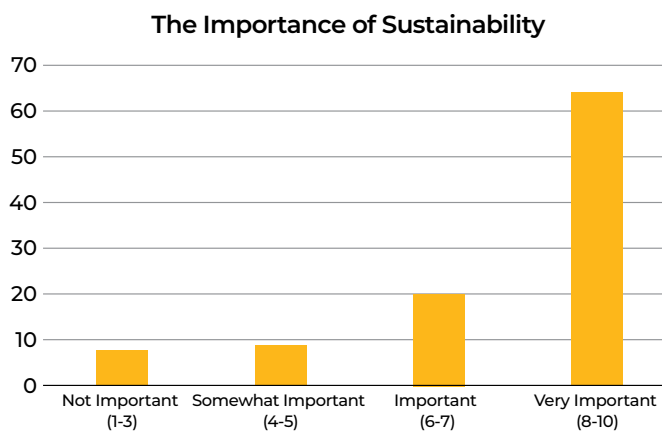


Figure 1. Survey respondents ranked the importance of sustainability to their organizations on a scale of one 1 to 10, with one being the least important.

Follow-up questions revealed that, in their quest for sustainability, companies are prioritizing reduced water usage, carbon renewal and capture, emissions reductions, increased energy efficiency, and materials circularity.

Simulation targets key areas specific to the automotive vertical: clean environment, materials circularity, energy, and manufacturing and operational efficiency. Environmental noise, lightweighting, electric motors, and advanced manufacturing are all examples of automotive industry solutions aligning with these targets.

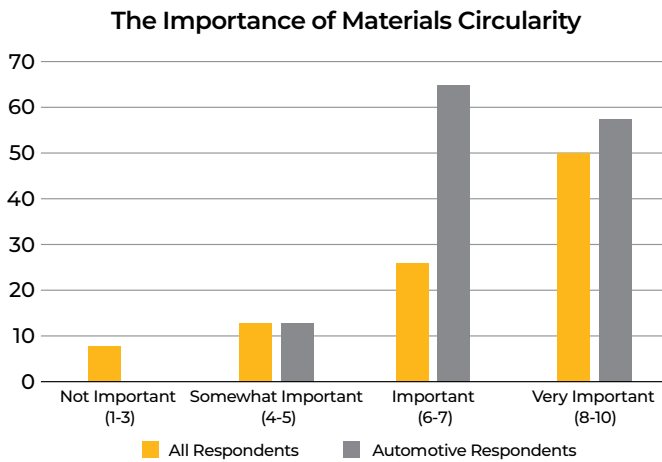


Figure 2. As a whole, survey respondents ranked materials circularity as very important to their company.

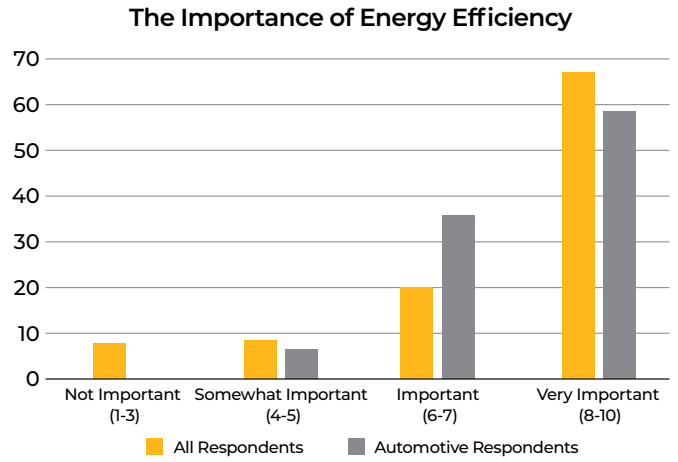


Figure 3. Respondents from all industries ranked energy efficiency as most important to their company.

On a scale of 1-10, with one being the least important, half of the respondents rated the importance of materials circularity as very important (eight or above). This is not surprising. As the automotive industry explores sustainable alternatives to reduce consumption and waste, engineers are focused on the accurate evaluation and comparison of different materials to optimize decision-making during the earliest stages of design. Another consideration is the use of recycled material where the physical properties are not as consistent as virgin materials.

As the industry explores sustainable alternatives to reduce consumption and waste, engineers need to accurately evaluate and compare different materials and optimize decision-making during the earliest stages of design. A strong materials solution is not only valuable in concepting, but throughout the product life cycle. It can serve as a digital thread for linking to a supply-base and enable better materials selection for modern automotive systems.

Does Your Company Use Engineering Simulation Software?

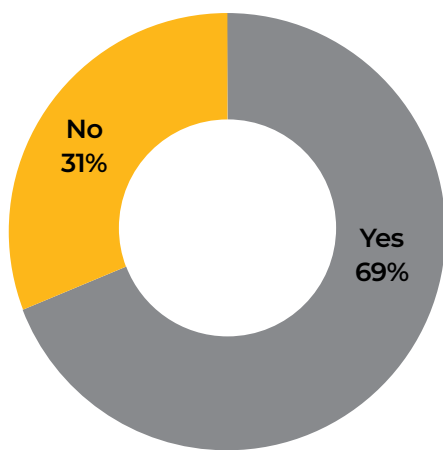


Figure 4. Most companies surveyed are leveraging engineering simulation software.

“We can use simulation software to test different materials and manufacturing processes to see which ones have the lowest emissions. We can also use simulation software to design products that are more aerodynamic and that produce less drag.”

— SURVEY RESPONDENT

When survey participants were asked about their companies' other specific priorities, many write-in responses could be directly addressed by an increased use of simulation — including achieving sustainability through reduced, more time-efficient testing. This included the desire to minimize customer cumulative total cost to perform product function, correlated with minimal material consumption.

Does Engineering Simulation Help Your Company Further its Sustainability Goals?

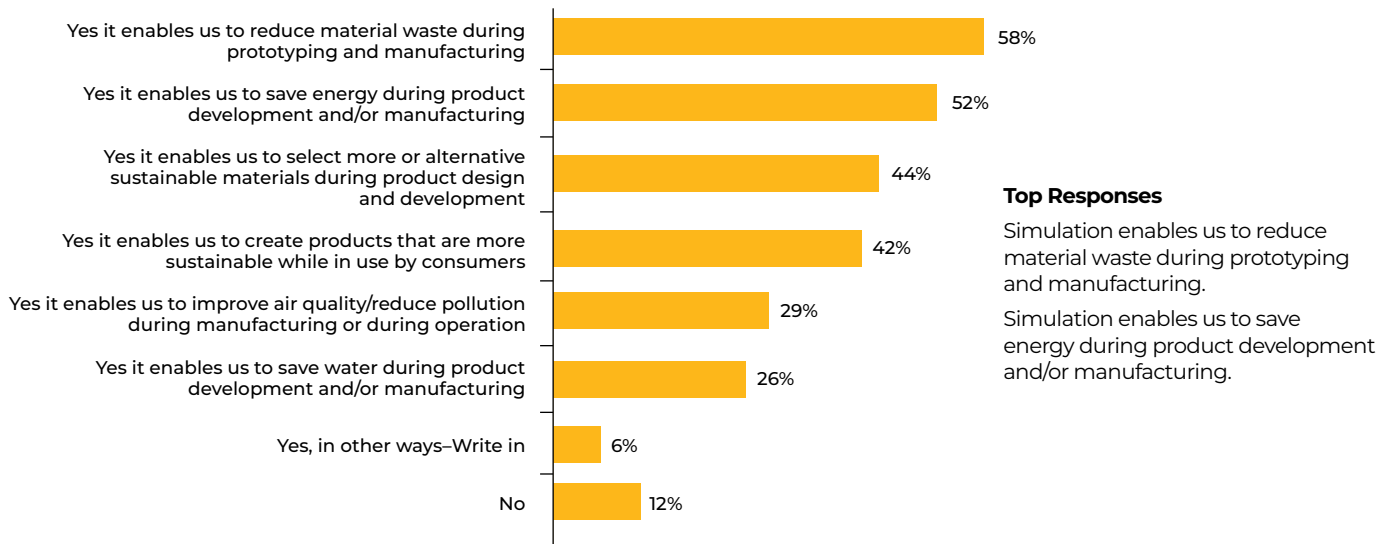


Figure 5. Of companies using simulation software, the overwhelming majority of respondents (88%, obtained by subtracting the 12% who answered "no" from 100%) said simulation was helping to further their company's sustainability goals.

Sixty-nine percent of respondents are already using engineering simulation software as part of their product development process.

When asked about specific benefits of engineering simulation, 58% of simulation users reported that it reduces materials waste during prototyping and manufacturing.

Just over half (52%) said that simulation saves energy during product development and production. The ability to select alternative sustainable materials was noted by 44% of simulation users, while 42% stated that simulation helps them design more sustainable products. Respondents also indicated that simulation helps reduce pollution (29%) and water consumption (26%) during product development and manufacturing.

More industry-targeted write-in benefits of simulation include achieving miles-per-gallon/or kilowatt-hour efficiencies, and the ability to create products with fewer resources that are more energy efficient.

“We use simulation to reduce project timelines, including prototyping and testing. This reduces environmental impacts throughout the design process and also saves money.”

— SURVEY RESPONDENT

Manufacturers cite the importance of simulation in validating engineering design to ensure it is robust enough and meets necessary criteria and standards before building a product.

When asked in their own words to explain how their company uses simulation/engineering simulation software to help meet its sustainability goals, respondents identified the need for simulation to assess alternative material performance and functional requirements, reduce the number of prototype iterations, and decrease material waste.

Methodology

Ansys commissioned Digital Engineering 24/7 to conduct an e-mail survey of engineering professionals to better understand how they use simulation in conjunction with sustainability efforts. The survey was conducted in July and August 2023. A total of 210 responses were received, with a margin of error at the 90% confidence level (+/- 5.7%).

Sustainability Success Stories with Simulation

For autonomous technologies, it is practically impossible to road test each feature with the range of test scenarios necessary because it would require millions of miles of testing. To help ensure safety, the automotive industry depends on simulation for sensor performance and feature validation. Using simulation as an optimization tool for scenario investigation helps customers identify the most likely edge cases to analyze and reduce the number of simulations, sometimes by a factor of 1000. The following examples highlight how Ansys is delivering on the need for rapid validation and iteration of automotive components and systems, as well as material considerations that lead to more sustainable development practices.

“Using Ansys AVxcelerate Sensors during ADAS/AD testing and validation, we were able to confidently test real-life scenarios that were previously off-limits to us with simulation, with complete confidence in the accuracy of our results.”

— **DR. MARTIN PUNKE** / Head of Camera Product Technology / Continental

Continental Uses Simulation for Scenario Analysis During ADAS/AD Testing and Validation

Continental, pioneer of sustainable and connected mobility technologies, used a multi-spectral lens output from Ansys AVxcelerate Sensors and fed that into Continental camera sensor models as part of their advanced driver assistance system/autonomous driving (ADAS/AD) testing and validation process. They then compared the results from the simulated output from AVxcelerate Sensors versus the real-life model measurements from Continental camera models side-by-side to analyze results. This enabled Continental engineers to validate more use cases and initiate future perception stack development without the real camera technology normally needed for testing and validation.

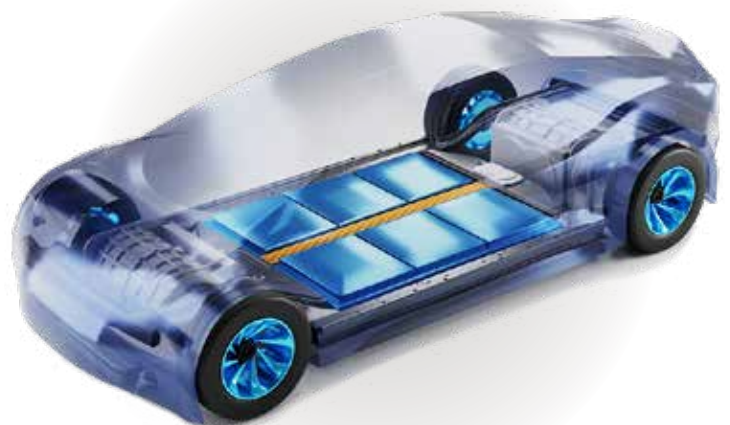


Material Intelligence Helps Kuraray Choose Polymers That Make Electric Vehicles Go Farther

Kuraray, a global leader in specialty chemicals and functional materials, is working with Ansys to develop a material solution that will help overcome electric vehicle battery challenges through lightweighting. Access to the extensive polymers library for Ansys Granta MI and Ansys Granta Selector — including detailed, simulation-ready data that could be easily exported into various Ansys tools and solvers — can now be used to identify new material choices through analysis that help their customers' electric vehicle solutions go further.

“These companies need to understand when they have to use virgin materials and when they can use a recycled material instead. And that’s where Ansys simulation solutions come in.”

— **DONNA DYKEMAN** / Research and Development Manager for Collaborative Development / Ansys

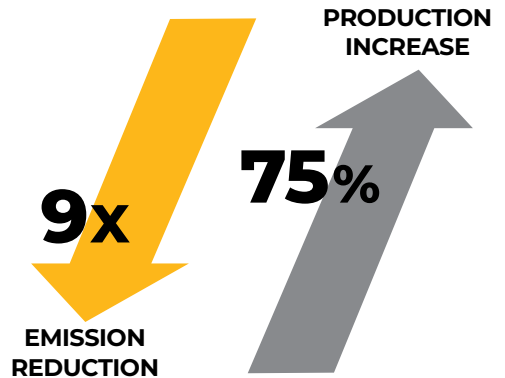


Far-UK Turns Recycling Waste Into Automotive Components Using Simulation

Ansys collaborated with three companies as part of the Plastic Recycling in Stochastic Modeling (PRISM) Project, which aims to make it easier for recyclers and their customers to create viable recycled plastics that can be used in products. One of the companies, Far-UK, an automotive parts manufacturer, used Ansys simulation for insight on how to manage the variability of materials from “recyclate” in designs, resulting in more efficient, economical material choices. Ansys Granta also helped Far-UK generate and validate a collection of material data for use across wider applications.

Another company, Impact Recycling,² was able to:

- Reduce costs for manufacturing recycled material
- Increase the rate of production from 400 to 700 tonnes per year
- Produce a new recycled plastic stream that addressed the high demand versus supply of recycled plastics in light of the plastic tax on consumer packaging (virgin plastic costs 30% more, driving the demand for recycled polyolefins)
- Promote their new recycled ABS thermoplastic stream to a wider application audience, such as automotive
- Reduce their CO₂ footprint, with emissions 9X less than when using virgin feedstock.



Improvements achieved by Far-UK using simulation.

Simulation Reduces Development Costs for Turntide’s Electric-Powered Construction Vehicles

Turntide Technologies, developer of electrification and sustainable operations technologies, is leveraging Ansys solutions to produce electric vehicle powertrain components that help its customers transform commercial and industrial vehicles from gas and diesel engines to clean, quiet, battery-powered electric machines. These simulations show the impact of extreme scenarios including weather, vibration, impact, and corrosive exposure to salt, sand, and chemicals, and provide performance and safety data that leads to optimized mobility solutions.



“A physics-based simulation using Ansys toolsets provides a significant business advantage. We estimate that we save about 25% on development costs by using simulation.”

— **BISWADIP SHOME** / Senior Director / Simulation and Analysis / Turntide

“Simulation is among the core elements of digital transformation needed to revolutionize our product development. Ansys’ solutions pay off in shorter development cycles and less prototyping — key points in digitizing our R&D processes that help us take our mobility solutions in new directions.”

— **DR. HELMUT SCHMID** / Manager in the Advanced Development Department / ZF Friedrichshafen AG

Maximizing the Efficiency of Electric Motors

ZF Friedrichshafen AG, a global technology company and systems supplier of electric drives for passenger and commercial vehicles, is enabling the next generation of mobility by developing systems and components they say can “see, think, and act” through hardware, software, and sensor technology. Using Ansys simulation, the company can calculate



thousands of different designs to find a very specific concept that can then be benchmarked against a similar competitive product in the market for factors including performance, efficiency, compactness, and cost. Simulation also enables ZF to deliver competitive, yet simple, electric motor designs that are standardized across their portfolio, giving the company a decided advantage in the ability to bring convenient mechanical power to these applications.

¹The World Resource Institute's Climate Data Explorer provides data from CAIT on the breakdown of emissions by sector. In 2016, global CO2 emissions (including land use) were 36.7 billion tonnes CO2; emissions from transport were 7.9 billion tonnes CO2. Transport therefore accounted for $7.9 / 36.7 = 21\%$ of global emissions. The IEA looks at CO2 emissions from energy production alone. In 2018 it reported 33.5 billion tonnes of energy-related CO₂ [hence, transport accounted for $8 \text{ billion} / 33.5 \text{ billion} = 24\%$ of energy-related emissions. Via Our World in Data, <https://ourworldindata.org/transport#co2-emissions-by-mode-of-transport>, September 2021, Hannah Ritchie and Max Roser.

²Ansys interview with Impact Recycling, <https://www.ansys.com/blog/recycling-waste-to-automotive-components>, Scott Wilkins, February 24, 2023.

Learn More About Sustainability and Simulation

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.

Ansys customers from virtually every industry are using simulation to meet their sustainability goals. Companies in the energy sector are reducing greenhouse gas emissions, improving low-carbon energy alternatives, and optimizing operations with digital twins that are enabled by simulation and artificial intelligence. Automakers are transforming into electric mobility companies, while also continuing to work on improving aerodynamics and reducing vehicle weight. The aerospace industry is exploring new propulsion and fuel storage solutions while implementing advanced manufacturing and model-based systems engineering (MBSE). The high-tech sector is using simulation to design more energy-efficient electronics that are designed with material intelligence to improve e-waste recovery. And heavy industry is transitioning to digital workflows that rely on the Industrial Internet of Things (IIoT) to optimize operations, save energy, and control pollution.

Please see additional information on Ansys' exciting technological innovations and corporate responsibility initiatives below.



Additional Resources:

- **Sustainability at Ansys**

Our simulation software empowers designers and engineers to assess and scale their sustainable innovations faster, reduce their environmental impact, and foster a better future.

- **Discover the Ansys Earth Rescue Online Video Series**

Earth Rescue reveals what visionary companies are doing today to engineer radical new ideas in the fight against climate change.

- **Read our Corporate Responsibility Report**

Highlighting our progress across our environmental, social, and governance (ESG) initiatives, the Ansys corporate responsibility report sets out our commitment to delivering positive change and long-term value for our stakeholders – our investors, customers, employees, and partners.

Questions?

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

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