

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 to Increase Energy Efficiency and Innovation

It's easy to see the broad environmental impact of Ansys software as it actively supports the development of more sustainable energy generation technologies, fuel sources, storage systems, and other product innovations.

But, like every Ansys customer, energy companies also benefit from the increased development speed and efficiency gained by using simulation software. By replacing manual, paper-based analysis and material-intensive physical prototypes with engineering simulation, companies can reduce waste, save on utilities costs and cut the overall development cycle.

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 energy 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.

When asked to rate the importance of sustainability to their organizations on a scale of one to 10, with one being the least important, 64% of respondents said sustainability is very important with a score of eight or above, and almost a quarter of respondents (24%) ranked it as a 10.

“Simulation software can help us to communicate our sustainability efforts to our stakeholders by providing them with data and insights into our environmental impact.”

— SURVEY RESPONDENT

Follow-up questions revealed that, in their quest for sustainability, companies are prioritizing reduced water usage, carbon capture, emissions reductions, increased energy efficiency, and materials circularity. Among these, energy efficiency emerged as a special area of focus.

Two-thirds of respondents (66%) rated energy efficiency as very important (eight or above), based on a scale of one to 10 with one being the least important. It was by far the most important of all the sustainability measures covered by the survey questions. In comparison, water usage was rated as very important by 43% of respondents, carbon capture by 42%, emissions reductions by 55%, and materials circularity by 50%.

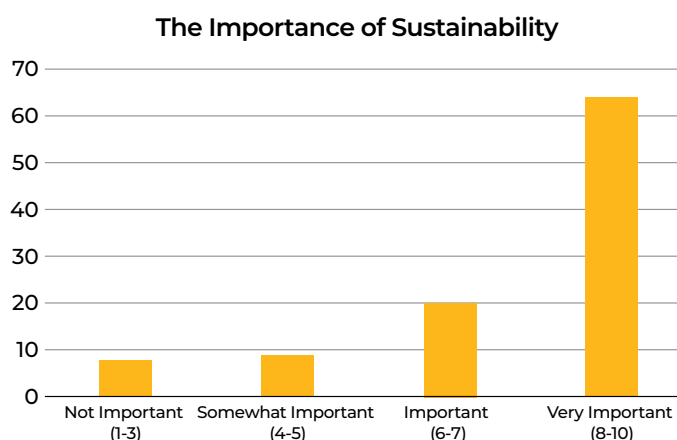


Figure 1. Survey respondents ranked the importance of sustainability to their organizations on a scale of one 1 to 10, with 1 being the least important.

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 engineering labor efficiency, reduction of paper usage, reduction in testing, and time efficiency. Simulation-driven product development can also address many other sustainability concerns of respondents, including product durability and longevity improvements, lowering maintenance, minimizing materials usage, and exploring more sustainable materials.

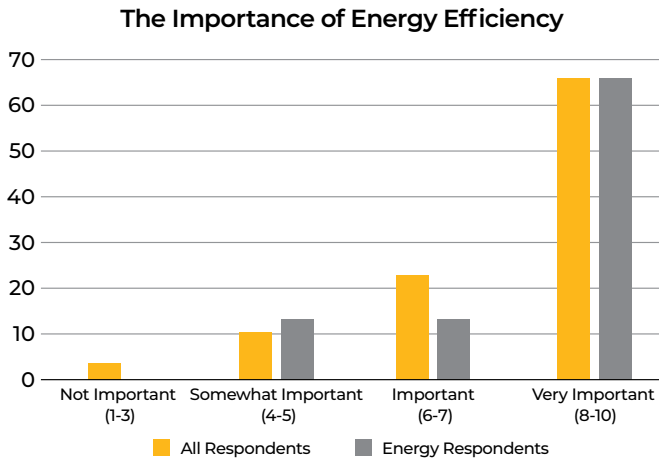


Figure 2. All respondents and energy-industry respondents ranked energy efficiency as being very important for their company.

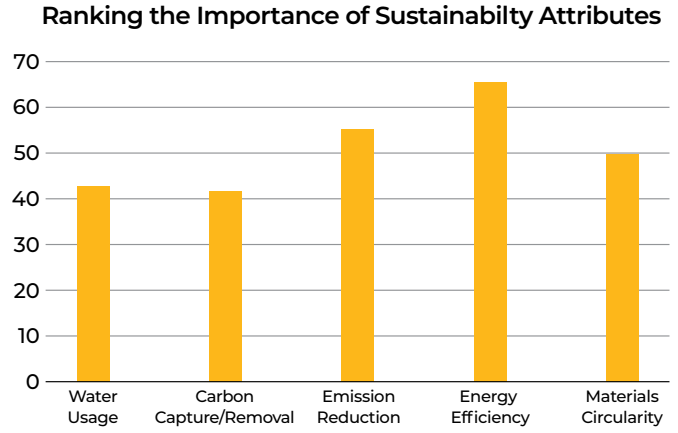


Figure 3. When asked to rank sustainability attributes important to their company on a scale of 1-10, with one being the lowest, 66% of respondents ranked energy efficiency as very important (8 or above).

“We use simulation software to identify ways to reduce energy consumption during product development and manufacturing. For example, we can use simulation software to test different design options to see which one is the most energy efficient. We can also use simulation software to optimize our manufacturing processes to reduce energy consumption.”

— SURVEY RESPONDENT

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

Does Your Company Use Engineering Simulation Software?

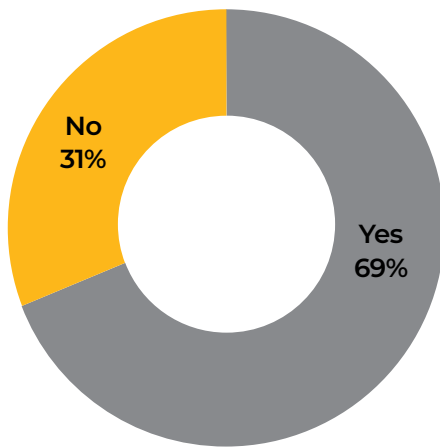


Figure 4. Most companies surveyed are leveraging engineering simulation software.

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

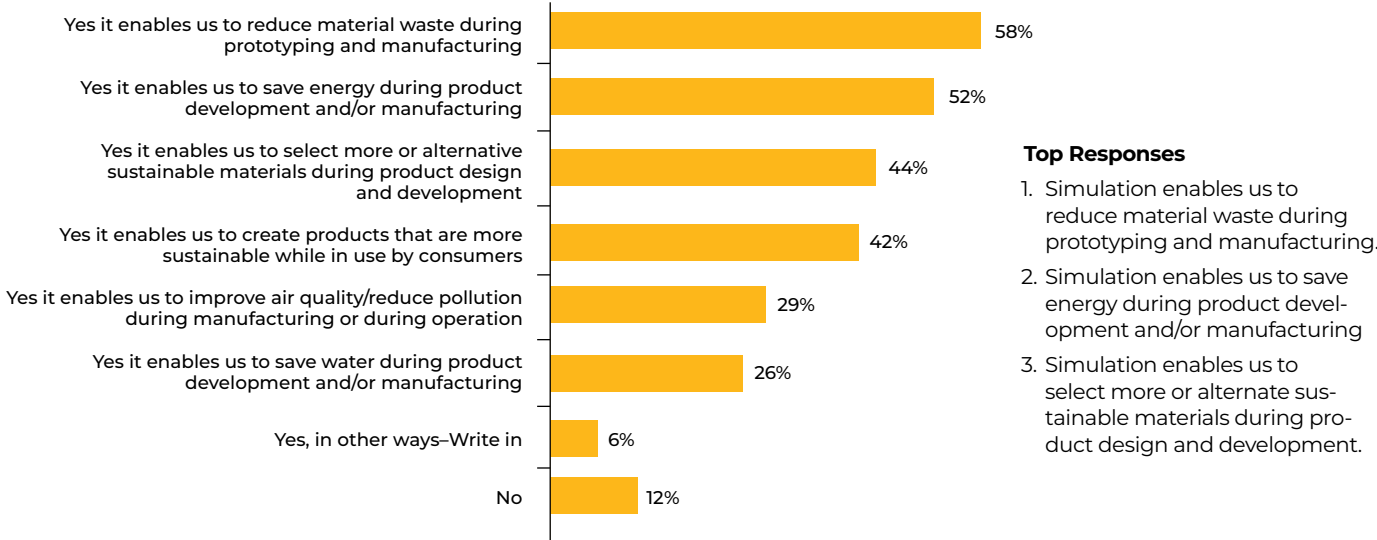
Just over half (52%) of all respondents pointed to the fact that simulation saves energy during product development and production. The ability to select alternative sustainable materials was important to 44% of simulation users, while 42% stated that simulation helps them design more sustainable products.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

Write-in benefits of simulation included compliance with environmental regulations, reduced labor requirements, fewer physical tests, improved materials traceability, faster development cycles, increased product reliability, and optimized efficiency.

“Our goal is to provide our customers with the safest, (most) reliable, affordable, and sustainable energy services available. Engineering simulation software helps provide a means to that end.”

— SURVEY RESPONDENT

Does Engineering Simulation Help Your Company Further its Sustainability Goals?



- Top Responses**
1. Simulation enables us to reduce material waste during prototyping and manufacturing.
 2. Simulation enables us to save energy during product development and/or manufacturing
 3. Simulation enables us to select more or alternate sustainable materials during product design and development.

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.

“Simulation software helps us determine the most effective use of our products, reduce waste, and create reworkable products where applicable. We can reduce raw materials needed, which significantly reduces carbon through manufacturing of new products and then the disposal and recycling of used products.”

— SURVEY RESPONDENT

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

Energy companies worldwide are focused on identifying new fuel sources, advancing energy generation processes, and designing more effective storage technologies. Ansys software plays a critical role in modeling, verifying, and launching these energy innovations rapidly, saving time and costs. The following are just a few examples of the energy innovations developed with the support of Ansys software.

“Ansys uniquely makes it possible and user-friendly at the same time to master the multiphysics tasks, which inevitably come together when developing complex systems such as wind turbines.”

— **DR. PAUL KÖSTER**, Lead R&D Engineer, siWING, Wismar, Germany

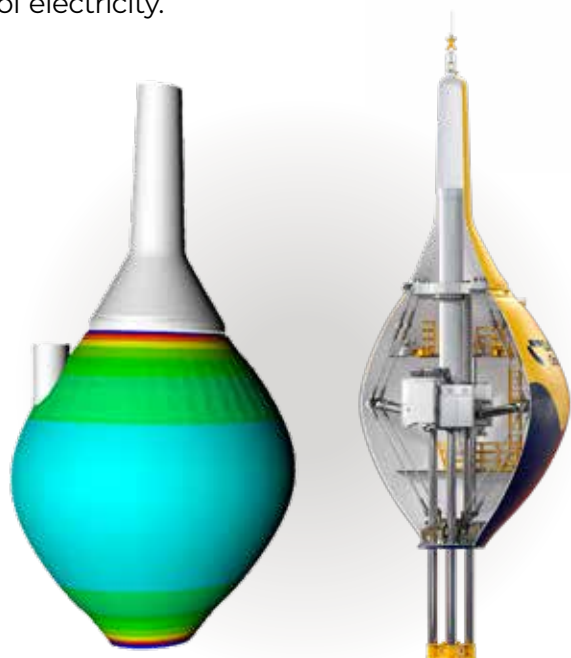
Source: SiWING Simulates new Small Wind Turbine Design (ansys.com)

siWING: Expanding the use of wind energy

An innovative startup company called siWING — shorthand for “smart, intelligent wings”— is leveraging a suite of Ansys software to revolutionize wind power with its line of ROTOLUS private wind turbines. Ranging in size from 6 to 24 meters tall, ROTOLUS turbines are capable of producing more than 25,000 kWh of energy per year — which could provide power or about five homes. Even its smallest designs can generate over 2,500 kWh, half of the average home’s annual energy needs.

CorPower Ocean: Harnessing the Power of Ocean Waves

Wave energy represents one of the world’s largest untapped sources of clean energy. To harness that energy, CorPower Ocean is using Ansys software to design and verify its innovative wave energy converters, designed as 19-meter buoys that are tethered to the sea floor. A cluster of buoys can produce 10 MW to 20 MW of electrical energy. Multiple clusters can be linked — all sharing a common electrical transmission infrastructure — to deliver gigawatts of electricity.



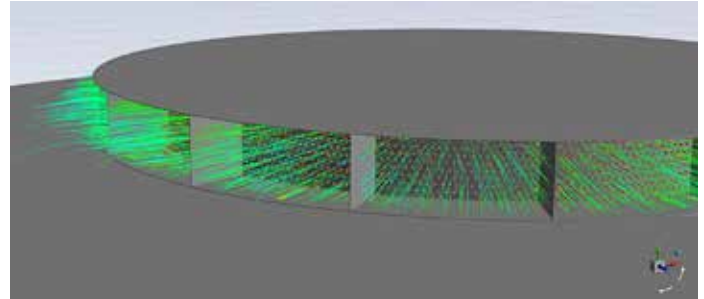
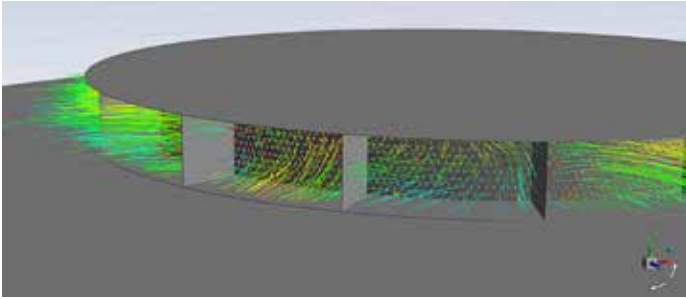
“We needed to design structures that are optimized for energy production, cost, and survival of extreme storms. For these tasks, Ansys Mechanical and Ansys Fluent provided powerful simulation support. The engineering teams used Mechanical and Fluent to model, test, and refine the physical size and shape of the buoys.”

— **JAVIER VERDEGUER**, Lead Composite Engineer, CorPower Ocean, Stockholm, Sweden

Source: Tapping Into the World’s Biggest Battery (ansys.com)

RayGen: Storing Solar Energy for the Long Term

Utility-scale energy storage is a big challenge for the solar energy industry. RayGen uses Ansys software to model key elements of what it says is the world's largest long-duration energy storage project. Raygen's solar energy-fueled power plant includes 1,200 concentrating mirrors called heliostats that track the sun. Energy is generated via photovoltaic modules, then stored as byproduct heat in a water pit. It's later converted to dispatchable electricity. The project is designed to deliver 4 MWh of solar generation and 50 MWh of storage.



“Using Ansys simulation has saved us months of design time ... Plus, instead of requiring significant capital expenditure on multiple prototypes and testing phases, we can be confident that we are progressing on the right track, both optically and mechanically, before we commit to constructing anything.”

— **THOMAS EVANS**, Mechanical Engineer, RayGen, Hawthorn East, Victoria, Australia

Source: Simulation Helps Harness the Power of the Sun (ansys.com)

C-Zero: Turning Natural Gas into a More Sustainable Fuel

Natural gas is a plentiful, low-cost energy source that provides about a quarter of the world's energy. C-Zero is using Ansys software to develop a process for decarbonizing natural gas and transforming it into pure hydrogen, a more sustainable fuel. In C-Zero's process, methane gas is fed into a reactor filled with a molten media, where it's heated to temperatures exceeding 1,000 °C. Hydrogen emerges as gas bubbles, while carbon is extracted in solid form. A pilot facility has proven capable of producing 400 kg of hydrogen daily.

“It's impossible to see inside the reactor vessel and observe processes like heating, mixing, separation, and deposition firsthand. So, we need to simulate that complex process in a virtual environment. Ansys has played a critical role in helping us see and understand the flow, thermal, and mechanical characteristics of the methane pyrolysis reactor, which is at the heart of our company's value proposition.”

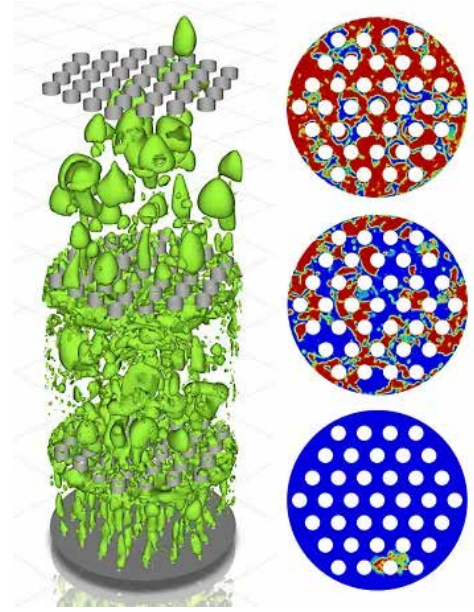
— **SAM SHANER**, Technical Director of R&D, C-Zero, Santa Barbara, California

Source: The Future of Hydrogen Looks Turquoise

“Wärtsilä uses Ansys software for complex battery storage system modeling to accurately test the life expectancy of our energy storage systems. With the help of Ansys simulation software, we were able to layer and build an accurate representation of our system that we can use to understand thermal management performance. Simulation also saved the team six months of development time and reduced the number of physical prototypes by three.”

— **DEWEI GUAN**, Product Development Engineer,
Wärtsilä, Helsinki, Finland

Source: Going with the Flow: Ansys Helps Wärtsilä Energy Power-shift Toward a Sustainable Future



Wärtsilä: Optimizing Battery-based Energy Storage Systems

Wärtsilä develops fully integrated energy storage systems that span solar, wind farm, and power plant applications. Each storage unit consists of battery cells, cooling and fire suppression systems, inverters or power conditioners, and control software. Excess energy is stored using lithium-ion batteries. Wärtsilä uses Ansys software to simulate the thermoelectric and electrochemical behavior of these batteries, along with transient heat transfer. The result? Battery designs that are optimized for stability, reliability, operation costs, susceptibility to degradation, and other performance aspects.



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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