



**Ansys**

*ACCELERATING  
**RENEWABLE ENERGY**  
WITH SIMULATION*

# ABOUT / ANSYS

When visionary companies need to know how their world-changing ideas will perform, they close the gap between design and reality with Ansys simulation. For more than 50 years, Ansys software has enabled innovators across industries to push boundaries by using the predictive power of simulation. From sustainable transportation to advanced semi-conductors, from satellite systems to life-saving medical devices, the next great leaps in human advancement will be powered by Ansys.

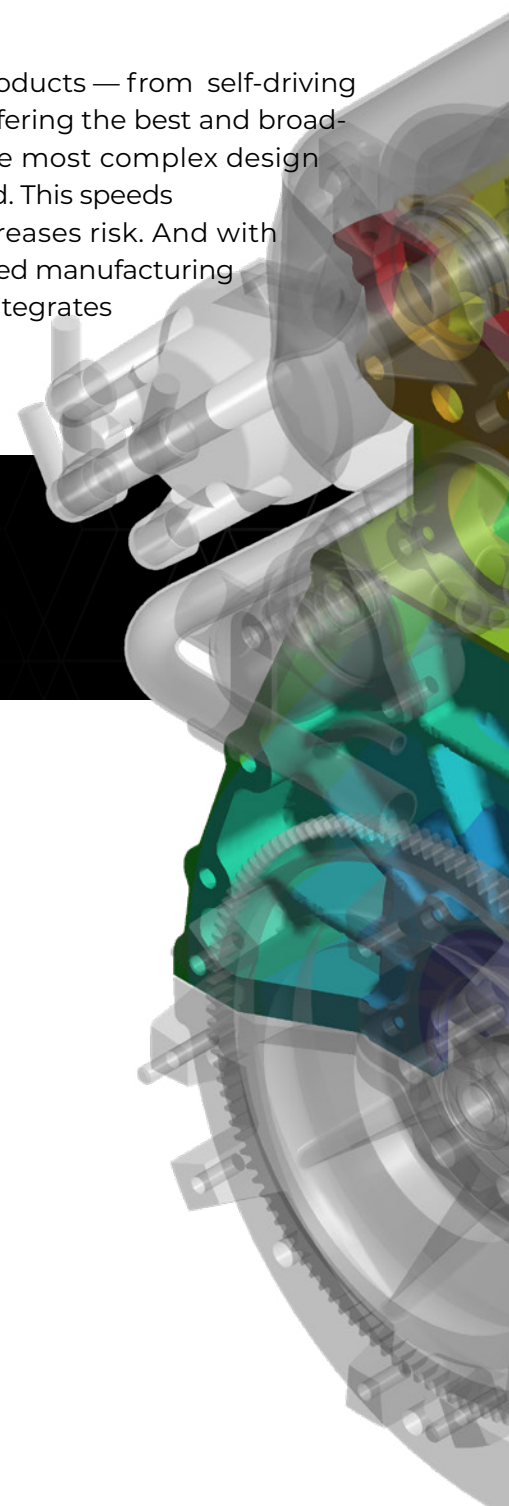
## TAKE A LEAP OF CERTAINTY ... WITH ANSYS.

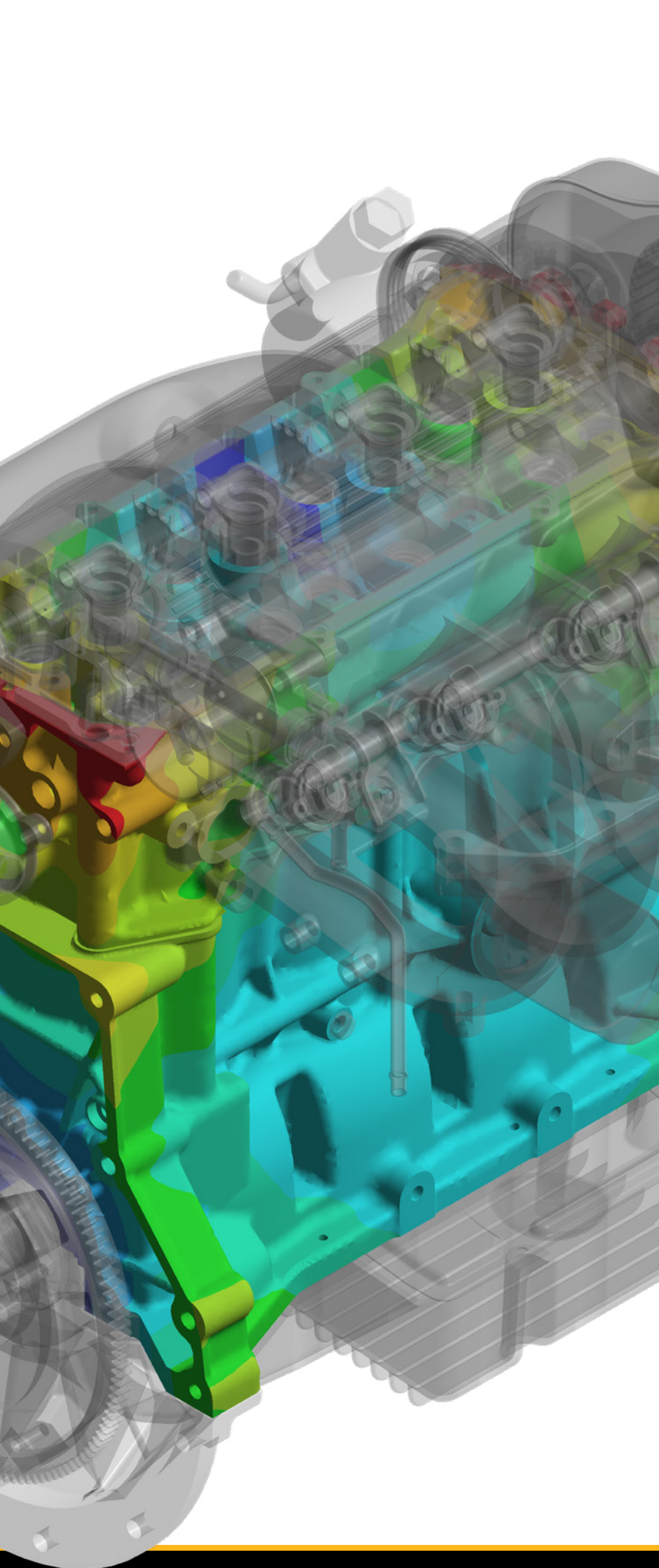
We help the world's most innovative companies deliver radically better products — from self-driving cars to electric aircrafts to connected cities — to their customers. While offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and explore and predict how products will work in the real world. This speeds time to market, lowers manufacturing costs, improves quality, and decreases risk. And with an open ecosystem between computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-aided engineering (CAE) providers, Ansys software integrates seamlessly into existing platforms.

**40,000+**  
CUSTOMERS  
WORLDWIDE

**450+**  
PATENTS

**750+**  
Ph.D.s





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# RENEWABLES / ENERGY SIMULATION SOLUTIONS

The efforts of the United Nations Framework Convention on Climate Change and the Paris Agreement have brought a sharp focus on climate goals — namely to keep the temperature increase by 2100 well below 2°C compared to pre-industrial levels.

Consequently, the race to net zero is accelerating, driven further by regulatory mandates and demand or pressure from customers and investors. In conjunction, the cost of renewable energy has decreased, which has led sustainable energy choices to now make fiscal sense as well.

Spurred by these factors, companies are considering how they can transform business or product offerings to meet ambitious environmental goals. Achieving these goals benefits companies financially, spurs future growth and investments, and protects the company's brand and image in an eco-conscious world. But before these goals can be met, companies must first develop new solutions and evolve existing technologies to align with environmental needs.

To do so, companies will need to adopt new ways of thinking. They'll need to analyze where energy is consumed and how it's used, as well as examine how resources are consumed in real time to identify areas for improvement. They'll need to audit their existing processes and identify causes of waste or sources of inefficiency, then use that analysis to develop alternative processes to remedy them. As a result, they'll be able to:

- Reduce / eliminate greenhouse gases
- Migrate electricity generation away from fossil fuels towards renewable sources
- Achieve more efficient power consumption
- Switch to environmentally safer materials
- Minimize freshwater use
- Ensure cleaner, more efficient manufacturing and operations
- Extend product longevity
- Eliminate waste
- Reduce environmental noise

Simulation is playing a vital role in helping industries and societies make this transition to a more sustainable future, accelerating the pace of progress toward net-zero carbon. Through simulation, companies can analyze the impact of sustainability of materials in production and disposal and assess material information based on implications to design, manufacturing, and disposal up front. They can understand the full life cycle impact with easy-to-use sustainability analysis tools and incorporate custom program indicators into their analysis. In doing so, they can achieve their sustainability goals in a way that still improves the bottom line.

# THE CRITICAL ROLE OF DIGITAL TECHNOLOGY IN THE ENERGY TRANSITION

Ansys simulation solutions enable a safe and reliable transition to a lower-carbon energy mix that will more sustainably meet the world's growing demand for power. Ansys is helping customers with simulation capabilities throughout the traditional oil and gas life cycle, including drilling and production, transport and storage, equipment reliability, processing and refining, and safety and compliance.

*Our product portfolio also helps our customers to capture opportunities within decarbonization initiatives and activities, such as electrification, advanced materials and manufacturing, autonomous systems, and digitalization and Internet of Things (IoT).*

## ANSYS CORE VALUES: ENVIRONMENTAL, SOCIAL, AND GOVERNANCE

By integrating environmental, social, and governance (ESG) objectives into our decision making, we can deliver long-term value for our business and our communities through:

**Advancing Sustainability Through Our Products** – Innovation is one of Ansys' core values. Our product handprints span numerous industries and show how the use of simulation helps our customers reduce their own carbon footprint and the footprint of their products.

**Investing in Our People and ONE Ansys Culture** – Our people are at the core of driving product innovation at Ansys, and we strive to attract, retain, and develop our people while furthering our commitment to diversity, equity, inclusion, and belonging.

**Operating Responsibly** – We aim to operate responsibly by measuring, analyzing, and reducing our environmental impact and actively seek sustainable building certifications. Acting with ethics and integrity is also integral to our business along with data security and data privacy practices.

**Collaborating with Stakeholders** – We believe collaborating with our stakeholders supports our business success and we're committed to engaging with our stakeholders including customers, employees, strategic partners, including start ups and universities, and the communities in which we live and work.

# CARBON / CAPTURE

To meet Paris Agreement climate standards, the world has to do more than attempt to simply reduce or offset carbon dioxide (CO<sub>2</sub>) emissions. It has to reverse course by removing the emissions that are already in the atmosphere, and then either reuse or sequester them. Extracting CO<sub>2</sub> from the atmosphere is not easy. At only 400 parts per million, CO<sub>2</sub> is exceptionally diffuse, making capture tedious and tough — and, until now, quite expensive.

## CARBON CAPTURE SOLUTIONS

For companies looking to rethink their carbon capture strategies, Ansys can provide simulation solutions including:

### ■ RETROFITTING WITH CARBON CAPTURE UTILIZATION AND STORAGE (CCUS) EQUIPMENT

Retrofitting facilities with carbon capture technologies and techniques can be a cost-effective option to improve sustainability while taking advantage of existing equipment. With simulation, companies can identify where and how retrofitting can occur to reduce downtime when making upgrades.

### ■ DESIGN AND SCALE-UP STUDIES

Simulation enables optimized design of carbon capture technologies, ensuring that they meet the designated requirements. Upon identifying an optimized design, simulation software can then be used to scale production up from a lab setting to a commercial setting.

### ■ ANALYSIS OF ABSORPTION, ADSORPTION, AND CALCINATION PROCESSES

Simulations can analyze and validate the efficiency of carbon capture processes such as absorption, adsorption, fluidized beds and chemical looping, among others.

### ■ PREDICTIVE MAINTENANCE USING ROMS AND DIGITAL TWINS

Advanced digitalization technologies, such as digital twins and reduced-order models (ROMs), can be used to optimize system operation and predict when maintenance is required. A virtual replica of a physical asset connects with sensors mounted on the asset consumes live data, feeds into a previously built simulated model, and mirrors the real-world experience of that equipment.

# CASE STUDY: CLIMEWORKS

## THE CHALLENGE

Swiss company Climeworks was looking to reverse the effect of CO<sub>2</sub> on climate change with direct air capture plants. The company wanted to develop efficient plants to decrease captured CO<sub>2</sub> costs and reuse captured CO<sub>2</sub> as a raw material for renewable fuels and materials.

The goal was to extract **1 ton of CO<sub>2</sub> out of 2,000-3,000 tons** of air. It needed to optimize design for airflow efficiency and energy consumption, accounting for airflow volume, speed, pressure drop, sorbent volume, and thermal cycling loads, stresses and fatigue.

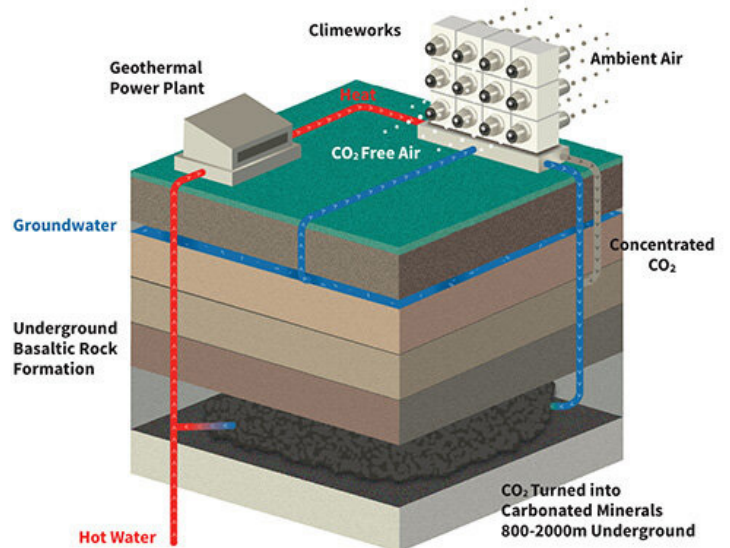


Image copyright Climeworks

## THE SOLUTION

Climeworks turned to Ansys for assistance in developing this new solution. Through Ansys' simulation software, Climeworks was able to evaluate 500 design variations of its new air collector to find the most efficient design.

## THE VALUE

This represented a time frame five to ten times faster than physical testing. At the same time, Climeworks increased filter capacity, reduced energy consumption, cut fatigue and failure risk, and decreased cost and size of plants.



# EMISSION / CONTROL

Energy efficiency is essential to convert crude oil and natural gas into fuels that provide energy to the entire world. Under pressure to reduce energy and resource consumption while eliminating or capturing emissions and waste, companies must meet stringent environmental standards. Simulation is a critical technology to improve existing environmental control systems and innovate new solutions.

## EMISSION CONTROL SOLUTIONS

For companies looking to rethink their emission control strategies, Ansys can provide simulation solutions including:

### ■ OPTIMIZING COMBUSTION PROCESSES

Ansys offers combustion simulation solutions for an array of products and configurations, from boilers to reformers and gas turbines including  $\text{NO}_x$ ,  $\text{SO}_x$ , and soot pollution models.

### ■ DESIGNING EMISSION REDUCTION TECHNOLOGIES

Our simulations offer accurate modeling for sprays and atomization, evaporation, solidification, and decomposition for complex emission reduction technologies, including selective catalytic reduction (SCR) systems.

### ■ IMPROVING EXHAUST GAS AND EFFLUENT WATER QUALITY CONTROL

Ansys has complex multiphase reacting flow capabilities for gas liquid contact equipment and liquid-solid flows with validated use cases spanning cyclones, precipitators, scrubbers, filters, reactors and settling tanks.

### ■ USING DIGITAL TWINS TO REDUCE EMISSIONS

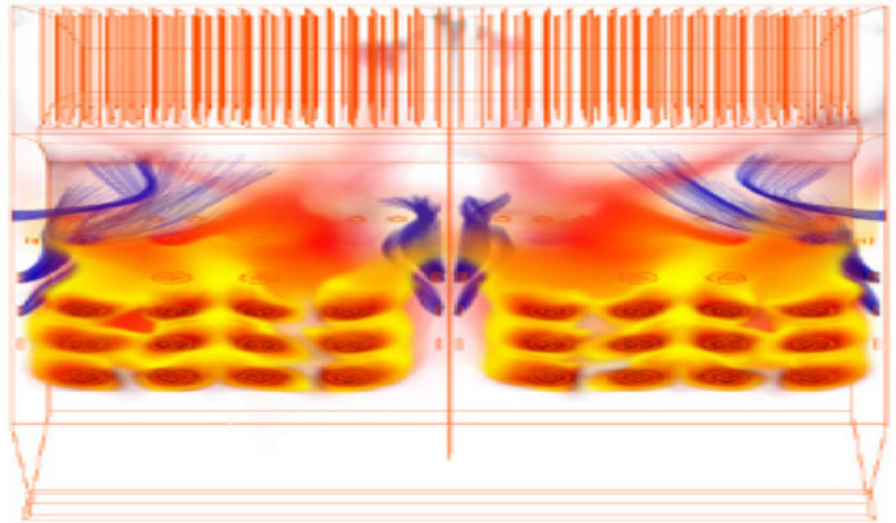
Creating a digital twin can enable more effective operation of assets, resulting in lower energy consumption overall. Plus, with real-time monitoring of the asset, a digital twin can help extend the useful life — saving the manufacturing emissions associated with building a new asset — and prevent fugitive emissions through potential leakages.



# CASE STUDY: RJM INTERNATIONAL

## THE CHALLENGE

In today's energy market, providing fast and cost-effective combustion solutions to reduce emissions, improve efficiency, and increase reliability is critical to new and aging combustion plants. Engineers must verify product integrity, ensuring it can successfully operate across a range of real-world operational conditions prior to prototyping.



A full furnace solid fuel combustion simulation.

Resolving complex emissions challenges for multiple coal, oil, gas and biomass-fired customers requires advanced simulation with improved accuracy and fidelity. Becoming larger and more complex, simulations are often run simultaneously to comply with demanding customer deadlines and require high-performance computing resources.

## THE SOLUTION

RJM International's engineers used Ansys HPC and parallel processing together with an OCF/Dell HPC cluster to analyze customers' existing operational systems and quickly solve large and complex simulations during an overnight run. This enables engineers to run more design variations and develop a complete analysis prior to prototyping. As a result, global power generators and other large combustion plants can now leverage enhanced designs that reduce emissions and improve efficiencies.

## THE VALUE

Simulations that previously required a week can now be completed within a day, enabling an 86% reduction in development time. RJM International was able to ensure systems were designed to be as efficient as possible and gained greater confidence, thanks to improved accuracy.



# HYDROGEN / TECHNOLOGY

Hydrogen is poised to reduce greenhouse gas emissions and help major economic sectors achieve their net-zero carbon objectives by 2050. That's the date many countries agreed to during a climate change summit earlier this year, and that the European Union, the United Kingdom, and other countries have already made legally binding. To meet that goal will require an overhaul of energy use for many industries and the advancement of a number of emerging technologies, according to the International Energy Agency.

Ansys technologies help customers to overcome challenges associated with hydrogen by improving performance at every phase of its ecosystem and accelerating new technology development to address the cost and scale conundrum.

## HYDROGEN SOLUTIONS

For companies looking to rethink their hydrogen strategies, Ansys can provide simulation solutions including:

### ■ STEAM METHANE REFORMING

Most hydrogen production happens using steam methane reforming, for which the typical yield efficiency ranges from 75-80%. Ansys simulation tools help not only improve yield efficiency, but also design/validate carbon capture technology for the steam methane reforming process. Adding carbon capture and sequestration to the process reduces CO<sub>2</sub> emissions, converting it to "blue" hydrogen.

### ■ WATER ELECTROLYSIS

Ansys has advanced modeling solutions to help customers achieve highly efficient electrolyzer design. Simulation ensures better partial load behavior and increases the power density of stacks. Using Ansys solutions, one can predict polarization curves and characterize gas flow with multiphase flow within the system.

### ■ PYROLYSIS / GASIFICATION

Ansys high-fidelity solutions for multiphase flows, detailed chemical reactions, discrete element methods (DEMs), and heat transfer on large and complex application helps customers improve plant efficiency. Ansys simulations can also help optimize overall pyrolysis process for maximizing syngas production.

### ■ HYDROGEN STORAGE, TRANSPORT AND DISTRIBUTION

Cryogenic storage and transport are at the core of the hydrogen ecosystem. Ansys composites solutions can be used to design cryogenic vessels while closely mimicking its manufacturing process. Another place Ansys tools provide big help is design and optimization of hydrogen network components such as cryogenic pumps and compressor.

### ■ HYDROGEN UTILIZATION

The most complex technical challenges of hydrogen combustion — such as flashback, acoustic instabilities, and autoignition — can be characterized and addressed with high-fidelity simulations. Ansys' streamlined solutions can help in designing and optimizing hydrogen systems.

# CASE STUDY: **HYDROGEN**

## **THE CHALLENGE**

A customer needed to improve overall plant efficiency of hydrogen production by pyrolysis, optimizing the pyrolysis process to maximize syngas production. The customer also needed to achieve efficient separation of particles in fuel vapor with clean and complete combustion.

## **THE SOLUTION**

The customer used pyrolysis and HPC to run simulations to find opportunities to improve efficiency. These simulations solved multiphase flow and explored detailed chemical reactions, DEM, and heat transfer on large and complex applications.

## **THE VALUE**

The client was able to optimize reactor /separator performance and improve different component design. In addition, it achieved ~25% improvement in heat efficiency. The project allowed for simulation democratization and predictive maintenance to save on operational cost, ultimately resulting in a reduction in emissions by helping to determine the best carbon control technology for the system.

***“These simulations solved multiphase flow and explored detailed chemical reactions, DEM, and heat transfer on large and complex applications.”***



# SOLAR / ENERGY

Replacing fossil fuel energy sources with solar energy is a more sustainable choice and can help companies get closer to net-zero goals. Beyond just solar panels, solar energy can be captured via solar artifacts such as patio umbrellas or benches and windows, among other structures. Running an accurate simulation helps more effectively determine the cost of solar conversions when offset by energy produced.

## SOLAR SOLUTIONS

For companies looking to rethink their solar power strategies, Ansys can provide simulation solutions including:

### ■ OPTIMAL PANEL POSITION FOR ELECTRIC POWER CONVERSION

To maximize electricity output from solar panels, it's necessary to evaluate and analyze possible panel positions. By accurately simulating spectral solar radiation under a variety of environmental conditions (geographical location, day of the year, time of the day, sky turbidity, etc.), companies can ensure that solar panels are best placed for highest efficiency.

### ■ SUPPORTING STRUCTURES RELIABILITY

Keeping solar panels up and running and reducing unnecessary repairs requires a solid supporting structure. By running simulations, companies can determine the proper mounting support for solar panels based on wind loading.

### ■ ELECTRONICS RELIABILITY

Safe and reliable delivery of electricity from renewable sources is necessary in any weather condition. With simulation software, companies can evaluate unlimited scenarios on a controlled virtual environment to predict efficiency, performance, and potential thermal events.



# CASE STUDY: CSIR-CMERI

## THE CHALLENGE

With India's large and growing population, the challenge of generating enough power to supply its people's needs is great. Increasing the number of renewable energy sources can solve this problem. Aesthetically pleasing designs of solar cells in the form of umbrellas or trees can be placed in public spaces while maintaining the space underneath for productive or recreational uses.

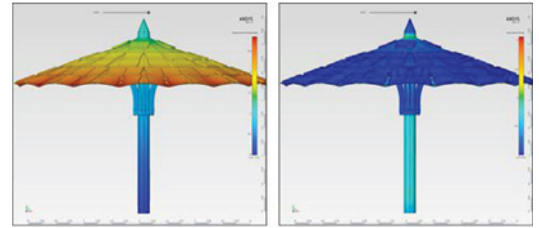
The solar designs developed by researchers at CSIR-CMERI needed to fit into the available space and be able to withstand a range of wind speeds depending on the location (beaches, parks, river banks, roadsides, lawns of bungalows, etc.).

## THE SOLUTION

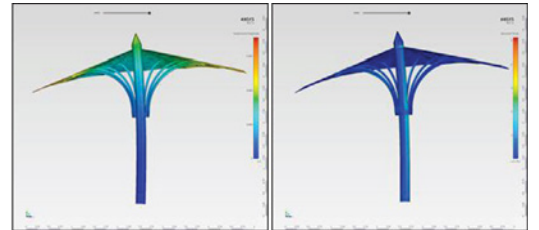
CSIR-CMERI researchers chose Ansys solutions to run fluidstructure interaction (FSI) simulations to determine the effects of wind gusts. They used Ansys SpaceClaim and Ansys AIM for pre-processing, meshing, solving, and post-processing in a single window environment.

## THE VALUE

The Ansys AIM functionality inside Ansys Workbench provided a new immersive simulation environment that lowers the barrier to entry for engineering simulation analysis of solar designs. AIM's single platform, combined with its guided and customizable simulation processes, made multiphysics FSI simulation accessible to the entire engineering organization.



Displacement plot at static condition (left) and stress plot at static condition (right)



Displacement and stress plots after applying wind speed at 80 km/hr.

Courtesy: CSIR-Central Mechanical Engineering Research Institute (CMERI)



# WIND / ENERGY

The global energy mix continues to rebalance, demanding more efficient, larger wind turbines that can operate in harsher environments — both onshore and offshore. Ansys provides a comprehensive multiphysics, multiscale simulation solution for wind turbine engineering development, manufacturing and in-service operations. Simulations can significantly increase productivity and performance: doubling the power output of a new wind turbine generator and increasing wind farm energy production by 5% without any design changes.

## WIND SOLUTIONS

For companies looking to rethink their wind power strategies, Ansys can provide simulation solutions including:

### ■ ROTOR AERODYNAMICS AND ACOUSTICS

When designing and manufacturing wind turbines, Ansys simulations can determine the turbine's noise footprint, so companies can reduce noise pollution where possible. They can also enable improved blade design to most efficiently capture wind energy.

### ■ STRUCTURE DESIGN AND MANUFACTURING

In an integrated environment, Ansys multiphysics simulations allow wind turbine engineers to address blade, nacelle, and tower structural design; power generation and transformation systems; and the embedded software and control systems. In addition, it can speed up the design cycle and reduce costs.

### ■ WIND FARMING

When planning wind farms, site selection is key. With an automated workflow for wind farm simulation — including energy prediction and predicted efficiency — Ansys simulations provide greater confidence when determining wind farm sites.

### ■ CONTROL SYSTEMS AND SOFTWARE

With an automated workflow for 3D computational fluid dynamics (CFD) wind farm simulation, Ansys solutions enable engineers to determine overall energy levels, optimize turbine layout, and assess farm behavior under specific wind conditions.

### ■ PREDICTIVE MAINTENANCE AND DIGITAL TWINS

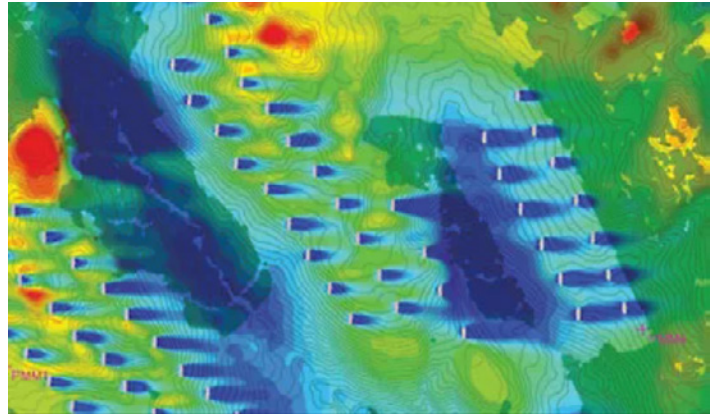
Through virtual sensors, the use of 3D reduced-order models (ROMs) and what-if scenario simulations, a digital twin of a wind turbine can be generated to optimize performance and maintenance requirements and scheduling.

# CASE STUDY: WIND

## THE CHALLENGE

Wind energy is a rapidly growing source of electricity. When developing wind farms, turbine siting assessment is critical to maximizing the energy yield and economics at a given location.

Detailed understanding of how wind conditions interact with the local terrain and potential wind turbine installations is an essential part of the process when developing onshore wind farms. Many software programs are not well suited to complex onshore terrain where factors such as atmospheric stability, forestry, and turbine interactions play a significant role. The accurate prediction of wind conditions including wind speed, wind shear, wind veer, and turbulence intensity under ambient and waked conditions is vital for intelligent project design.



An Ansys customer used a digital twin to optimize turbines to changing wind conditions and orchestrate the interaction of individual twins on-site. This achieved a 5% additional output from the wind farm and reduced service disruption and maintenance hours.

## THE SOLUTION

The customer deployed Ansys CFX with WindModeller onto the in-house high-performance computing (HPC) cluster. Using Ansys CFX, the customer ran multiple simulations to not only calculate the wind resource, but also to assess site suitability for a particular turbine type — ensuring that the site turbulence conditions will not adversely affect the turbine lifetime. The customer used more than 25 onshore development and operational wind projects across its portfolio to produce validation results.

## THE VALUE

Ansys CFX with WindModeller has become an essential part of the customer's wind farm development toolset. With accurate modelling of complex wind climates and turbine placement optimization, the customer can significantly reduce the risk posed to long-term asset integrity. In addition, the customer can now more easily run energy production assessments, site suitability analysis, turbine positioning, and turbine model selection. As a result, a 1% improvement on yield can generate significant additional revenue on a typical 100-MW project over a 20-year lifetime.



# MATERIALS / INFORMATION MANAGEMENT

If your organization makes or designs products, it uses materials. Materials are critical to every step of developing sustainable products — from determining whether products can be manufactured efficiently to reduce waste, to using lighter materials that help reduce fuel consumption and ensuring they can be recycled. Companies across the board need material data to help them meet stringent environmental standards and their own waste reduction and cost-saving goals.

## MATERIALS INFORMATION MANAGEMENT SOLUTIONS

Material choices are increasing dramatically and becoming ever more complex. At the same time, legislation changes constantly and requirements differ by geography. Consequently, it is essential to choose the right materials from the start.

For companies looking to rethink their material information management strategies, Ansys can provide simulation solutions including:

### ■ IDENTIFYING RESTRICTED SUBSTANCES

Combine all materials information in one place, import and manage supplier declarations more easily. Access reference data to fill in information gaps on restricted substances.

### ■ SELECTING COMPLIANT AND SUSTAINABLE MATERIALS

Get more information on the carbon and energy footprint consumed by certain materials, as well as energy and water usage and recyclability. Find and compare multiple materials, then map materials to the library of >4,100 generic materials.

### ■ DE-RISKING DESIGNS

Evaluate the impact of global legislations on bill of materials with Ansys Granta MI BoM Analyzer. Run multiple “what-if” scenarios to support key design decisions.

### ■ FULFILLING REPORTING OBLIGATIONS

Keep up with requirements and store all data in one place to ensure compliance with different reporting obligations.

# CASE STUDY: **BAKER HUGHES**

## **THE CHALLENGE**

Prior to undertaking its digital material management journey, Baker Hughes stored valuable product design materials data inside numerous spreadsheets, which had no single repository, poor accessibility, and no version control. Additionally, material equivalence searches were performed on the web with no tracking of search criteria against design requirements. Material assignment was conducted as free text, printed on 2D drawings, with material design properties requiring manual transference into CAD/CAE and product life cycle management (PLM).

## **THE SOLUTION**

Baker Hughes used Ansys Granta MI Enterprise to manage, within a single platform, the entire materials data life cycle for all commercial and custom materials. With Granta MI, one workflow powered a standardized business process for materials data review and approval. At the same time, MI: Materials Gateway solutions integrated directly with CAD, CAE, and PLM systems, streamlining the design process.

## **THE VALUE**

Baker Hughes was able to digitalize its materials data into a single platform, with traceability, version control, security, and easy access for end users. With a standardized workflow, it's now easier to create and update both commercial and custom materials, while running faster and more controlled material equivalence searches.



## OUR COMMITMENT / **TO NET ZERO AND OUR CUSTOMERS**

As the global leader in simulation software, Ansys is well positioned to 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 reduce the use of resources while increasing efficiency and productivity.

While the typical carbon footprint in our industry is relatively light, Ansys is committed to the conservation and sustainability of our planet's resources by aiming to operate our business in ways that continue to reduce our environmental impact and carbon footprint. Discovering and implementing efficient ways to make things operate — with minimal use of physical resources — is at the very heart of our vision of pervasive simulation. Ansys is environmentally responsible in its operations, and we encourage and support our stakeholders, including our vendors and customers, to do the same. Each year, we publish our corporate responsibility report to highlight our progress across our environment, social and governance (ESG) initiatives. In an unprecedented year of challenges and change, we continued to deliver long-term value for our stakeholders — our investors, customers, employees, and partners.

### **HOW ANSYS IS SUPPORTING OTHER INDUSTRIES AROUND 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.

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 Carbon Disclosure Project submission in 2020 and are committed to taking steps to measure and mitigate the carbon footprint of our operations.

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.

# THE POWER OF ANSYS SIMULATION FOR / **SUSTAINABILITY**

## **WHAT STANDS BETWEEN US AND A HEALTHY PLANET?**

Scientists and engineers are working to scale their sustainable innovations faster with the predictive power of simulation.

Simulation is essential to showing precisely how products will work, enabling innovators to move confidently from idea to reality at the pace our planet needs now.

Delivering on efficient energies — from wind, solar, hydrogen, consumer waste, biofuel, and more — involves solving complex, physics-based challenges.

## OUR SUSTAINABILITY PILLARS

### **Clean Environment**

- Emission Tracing and Control
- Carbon Capture, Utilization and Storage
- Water Treatment & Management
- Environmental Noise
- Dust
- Orbital Space Debris

### **Materials & Circularity**

- Materials Management and Selection
- Packaging
- Lightweighting
- Chemical Safety
- Compliance and Traceability
- Recycling, Reuse

### **Energy Solutions**

- Wind, Solar, Hydrogen, Nuclear and other alternatives
- Integrated Energy Systems
- Storage Solutions
- Electric Motors
- Fast Charging Batteries and Fuel Cells

### **Manufacturing & Operational Efficiency**

- Advanced Manufacturing
- Digital Twins
- Prognostic Health Management
- Energy Efficiency
- Reliability, Durability
- Workflow Optimization
- Process Automation
- Safety

***The next great leaps in human advancement  
will be powered by Ansys.***

### **Questions?**

Whatever your renewable energy solution needs are, Ansys can help. Our robust suite of simulation software supports sustainability efforts across a range of industries, and we'd love to show you how.

Visit [www.ansys.com](http://www.ansys.com) for more information.



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