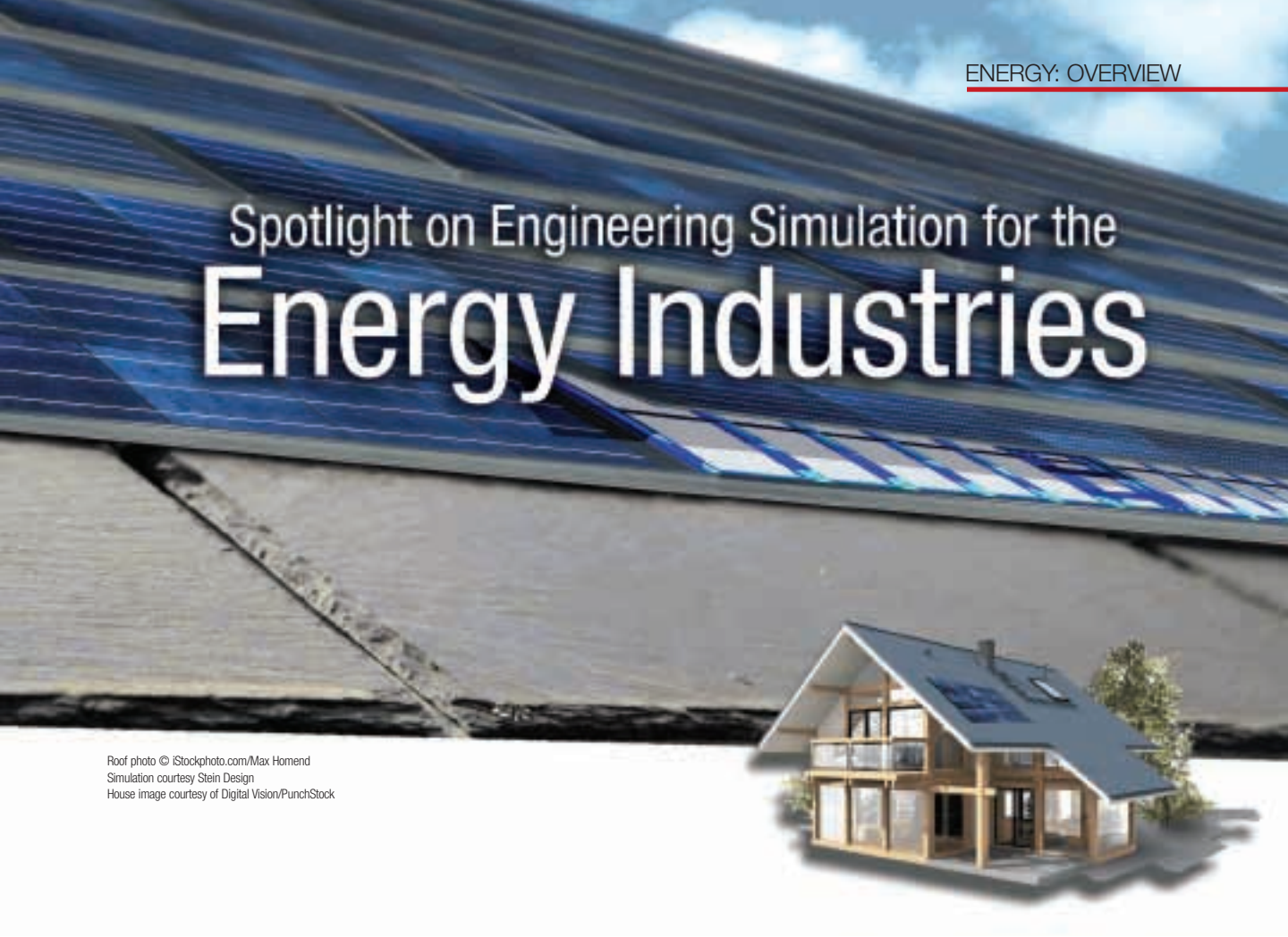
Spotlight on Engineering Simulation for the

Energy Industries



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The Global Challenge

As engineers and technologists rally to meet energy and environmental demands, they turn to engineering simulation to solve their most complex problems.

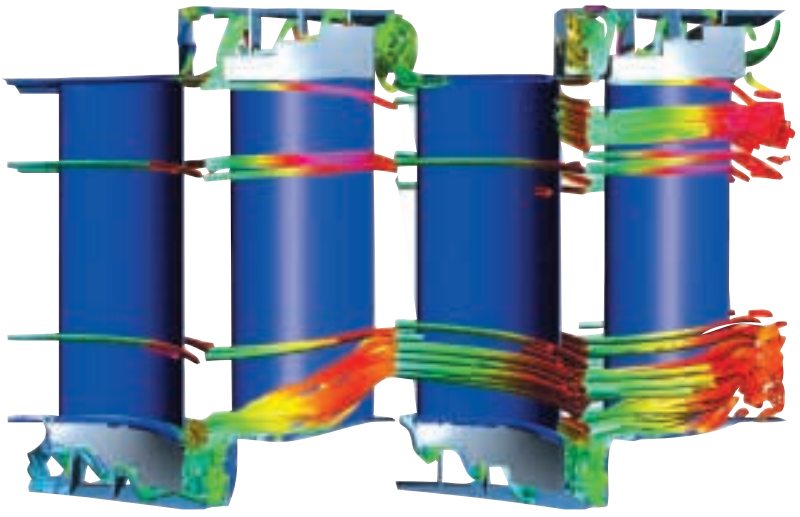
By Ahmad Haidari, Director of Industry Marketing for Process, Energy and Power, ANSYS, Inc.

The demand for energy, regardless of rising costs, is driven by a combination of population growth, global industrialization and the desire for improvements in quality of life in the remotest corners of the world. The increasing worldwide need for reliable energy at a reasonable cost, combined with environmental concerns, has brought science and engineering together into the spotlight. The collective challenge is to utilize technology to answer the call to find high-yielding biomass, deliver affordable oil and gas, develop clean coal, harness the sun's power, capture the wind and "turn" the tides. The potential benefits are there, but the projects are complex and the efforts, in business and human costs, can be enormous. For example, energy industry engineers are being called upon to:

- Drill deeper and in harsher environments with reduced environmental impact
- Develop technology to reduce greenhouse gases and the overall carbon footprint
- Make wind and solar power more cost-effective and scalable
- Increase fuel cell reliability
- Build cheaper, safer nuclear power plants
- Reduce energy consumption through improved efficiency and retrofits

Energy companies and related industries are applying engineering simulation technology at a high rate, indicative of an ongoing "energy revolution." Companies both large and small and in many sectors deploy solutions from ANSYS, Inc. to optimize design and engineering approaches in

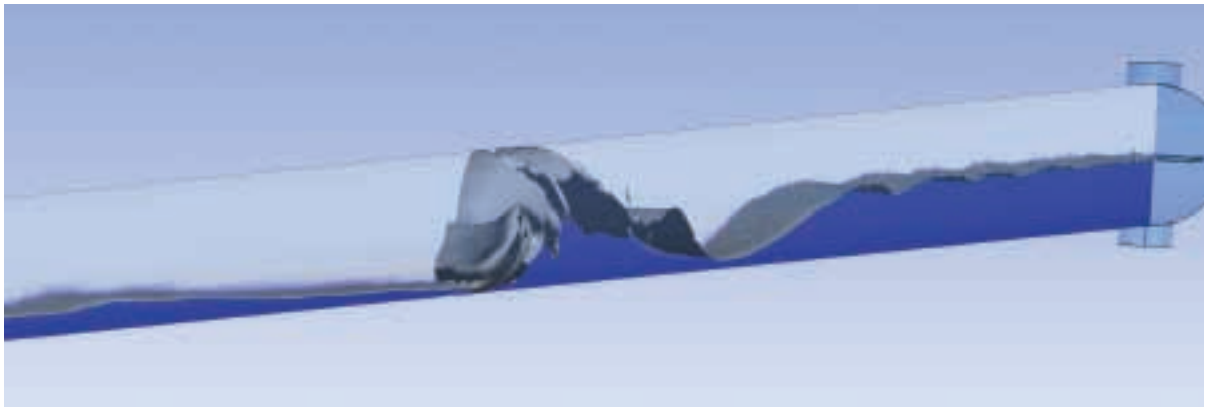
applications ranging from energy production and processing to conservation and end use. The broad acceptance of technology from ANSYS is, in part, due to the company's unwavering focus on the energy industry along with continual investment in expanding capabilities. For years, many components of ANSYS technology have been applied to the energy industry. Turbomachinery application products are used in rotating equipment, including hydroturbine and power system design. To meet nuclear regulatory concerns, ANSYS follows NQA-1 quality classification for its ANSYS structural mechanics software. Products in the offshore suite are used for oil, gas and wind turbine offshore installations as well as for ensuring that installations are up to industry-specific regulatory standards (code check). ANSYS pressure vessel capabilities help engineers meet ASME code requirements and are used in stress analysis of tubes, boilers and storage tanks. Explicit analysis capabilities are used for catastrophic event simulation, including impact and explosion.



Engineering simulations are used to study micro-cracks and fatigue to evaluate turbine performance at higher pressure and temperatures.
Courtesy Siemens Power Generation

The undeniable demand from the energy sector is for a strong emphasis on the quality and reliability of simulations. In addition, there is a need for engineering software that models as much of the overall system as possible. ANSYS provides true multiphysics tools for applications in which there is little or no opportunity for simplification, of either the physics or the detailed geometry. As an example, the unparalleled breadth of tools from ANSYS is ideal for studying enhanced oil recovery (EOR): exploring soil mechanics, rock fractionation, drilling, and thermally enhanced oil extraction concepts in which engineers can combine an explicit study of rock fracture in a same-simulation environment as they assess the transport of sand away from the reservoir.

Another requirement is for engineering simulation tools to be scalable, available for use on an



Technology from ANSYS is applied to flow assurance projects dealing with oil flow ability (addressing sand management, slug flow and gas-lift applications), ensuring more efficient and uninterrupted flow of oil in a given pipeline. This example shows slug flow in a gas-liquid pipeline.

engineer's desktop, across the work group or for enterprise deployment — based on an organization's specific needs. Global energy companies leverage the flexible architecture of solutions from ANSYS for worldwide projects that address, for example, offshore platform design, building and retrofitting nuclear plants, designing and installing wind turbines, and developing clean coal technologies.

Similar to other industries, especially recently, energy projects and product design applications are restricted by demanding time schedules. Engineers must get reliable answers from their engineering simulation activities in a reasonable time-to-solution. Features in ANSYS technology, such as two-way CAD associativity and an intuitive workflow environment that reduces the time needed to set up problems, lead to efficiency. Organizations also are looking to reduce the engineering hours needed to run complex engineering simulations. Advances in high-performance computing (HPC), along with the exceptional performance of ANSYS products on these machines, are proving to be valuable in simulating real-world problems in the energy industry. Continual HPC improvement means that simulations with large computational cells are being modeled routinely, benefiting from near-linear scalability of ANSYS software tools in parallel processing simulations.

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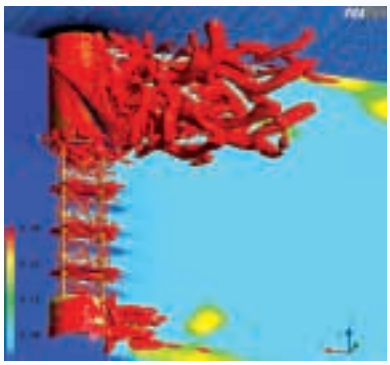
For environmental, green and sustainable design, engineers use simulation tools from ANSYS to evaluate retrofit options, optimize combustion and heat transfer, capture pollutants, design pipelines and sub sea equipment, look at safety and installation strategies, and increased structural integrity to avoid spills and disruption, Vortex-induced motion for this truss spar is modeled to understand global and local forces on the spar streaks. Geometry courtesy Technip U.S.A.

There has never been a greater need for engineering simulation to help conserve energy, to bring a plant online months or years ahead of schedule, to evaluate an innovative energy concept, or to improve equipment efficiency. Even small improvements can reap big benefits, whether the end product is brand new or a retrofit. Today, engineers successfully employ simulation tools to design new equipment that uses less energy, whether power, steam or heat. Through analysis, development teams retrofit oil and gas, refining, and power-generation equipment, looking to improve throughput and reliability, avoid unacceptable interruptions, and increase product life. This broad acceptance of engineering simulation tools puts ANSYS in a unique position to help power the world.

This industry spotlight highlights customer successes and details a few examples in which many of the ANSYS solutions are used in engineering simulation related to the energy industry. The selected articles capture the benefits customers have reaped in transforming leading-edge design concepts into reality in nuclear, fuel cell, solar power, wind turbine, and equipment retrofit and design applications. ■

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