/Ansys

ENVIRONMENTAL
SUSTAINABILITY IN FOCUS

SIMULATION PRODUCT HANDPRINT:
GAS TURBINES

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. 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 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.

PRODUCT
HANDPRINT
I N I T I A T I V E

Traditional coal- and oil-powered turbines have long been used to produce electricity to power our cities globally, but they emit climate-changing greenhouse gases (GHGs). Global CO_2 emissions from the electricity sector are predicted to increase by 3.5% in 2021 and by 2.5% in 2022, reaching an all-time high, according to the International Energy Agency.[1]

Switching from coal and oil to natural-gas-powered turbines would reduce the CO_2 equivalents (CO_2e) released into the atmosphere. An Ansys-commissioned study by Evalueserve estimates that between 2019 and 2030, CO_2e emissions due to gas turbines deployed in the power generation sector and aviation will account for 520 – 609 million tonnes of CO_2e.[2]

Simulation solutions are key to developing more energy-efficient gas turbines, resulting in lower carbon footprints in the power generation and aerospace industries.

The leaders in the transformation from coal- to gas-fired plants and the optimization of more efficient gas turbines for aviation rely on simulation to bring these emission-reducing advancements to market more quickly.

Simulation solutions are helping OEMs to deliver more energy-efficient turbines, significantly reducing fuel burn and thereby reducing emissions.

Design and Structure Optimization

OEMs are exploring new designs that will reduce costs and size, increase reliability and speed time to market while reducing the number of design iterations.

Engineering analysis by OEMs in areas such as modular design, material selection, modeling of vibration, fatigue and stress are helping companies to develop turbines that require less maintenance, are lighter and operate faster than older models.[3][4]

Environmental Compliance

As regulations on GHG emissions increase worldwide, OEMs are required to meet specific targets in order to deliver less-emitting gas turbines.

SImulations analysis helps OEMs to test noise, CO_2 and NO_x emissions, and make necessary design changes to verify reliability and compliance of new turbines, reducing overall emissions.
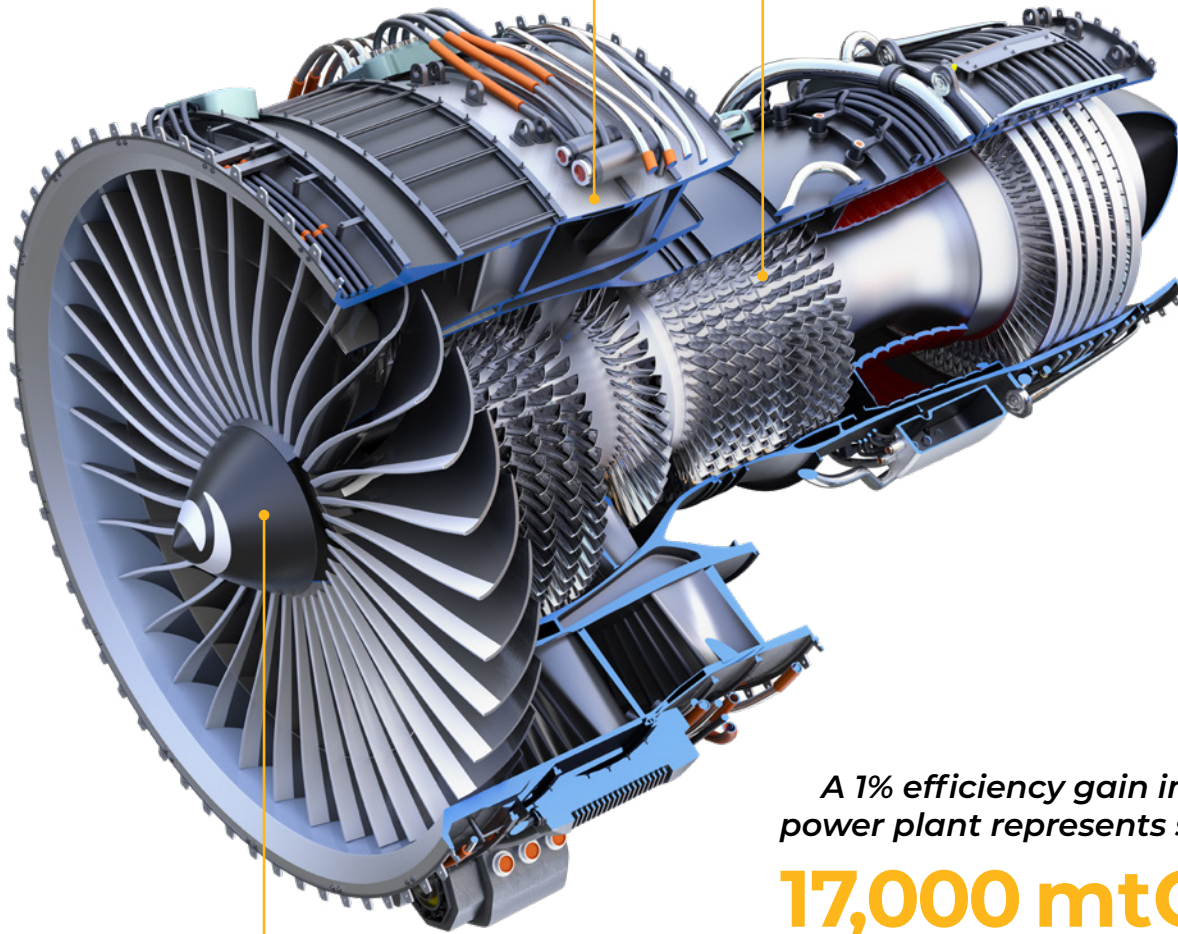
Efficiency Improvements

OEMs are looking for measures to increase conversion efficiency in new models as well as in existing ones through retrofits.

Simulation in areas such as heat transfer, cooling and blade rotation allow companies to predict critical design issues and help them find alternatives to maximize power conversion.[3]

A 1% efficiency gain in a 1GW power plant represents savings of

17,000 mtCO$_2$e

per year, which corresponds to taking ~3,500 internal combustion engine vehicles off the road[4]

Energy Efficiency

Through computational fluid dynamics (CFD) simulation, Purdue Engineers were able to achieve a 20% increase in heat transfer while maintaining the same blade temperature, increasing thermal efficiency for a new turbine design.[5]

Using Ansys' computational fluid dynamics (CFD) simulation solution Lufthansa has used Ansys simulation to increase the thermodynamic performance of its engines, leading to a reduction in fuel consumption and an increase in the lifespan of turbine blades, which reduces maintenance costs.

Design and Structure Optimization

Ansys has helped Turbomeca to achieve a 30% reduction in development time and a 50% decrease in the number of open problems for its new helicopters' engine design.[6]

Environmental Compliance

For Pratt & Whitney's geared turbofan engine, Ansys solutions have helped to achieve a 15% improvement in fuel burn, representing 3,000 mtCO2 savings per plane annually.[7]

Summary

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. Please see additional information on Ansys' exciting technological innovations and corporate responsibility initiatives at www.ansys.com.

References

(1) IEA Electrricity Market report, July 2021, page 3
(2) Evalueserve analysis commissioned by Ansys, based on an Evalueserve analytical model of various data points
(3) Evalueserve analysis commissioned by Ansys, based on an Evalueserve analytical model of various data points, including (a) Global Energy Observatory, (b) Grand View Research (web archive), Gas Turbine Market Size, Share & Trends Analysis Report By Capacity (≤200 MW, >200 MW), By Technology (Open Cycle, Combined Cycle), By End-use (Industrial, Power & Utility), By Region, And Segment Forecasts, 2020 - 2027, and (c) Statista, Installed natural gas power generation capacity worldwide in 2020, with a forecast until 2050
(4) Oak Ridge National Laboratory, Better Combustion for Power Generation - May 2016

(5) Ansys Advantage, Best of Turbomachinery, Powered by Innovation, page 41
(6) Ansys Advantage, Best of Turbomachinery, Breaking the Code, page 49
(7) Ansys Advantage, Best of Turbomachinery, Powered by Innovation, page 44

Questions?

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