

HIGH EFFICIENCY VIA HIGH TECHNOLOGY

The steam turbines business unit at Siemens is a leader in delivering powerful, efficient machinery to the global power generation industry. However, the company's long tradition of engineering excellence means that there are only incremental performance gains to be realized from its new product designs. Here, head of Global Steam Turbine Technology, Leif Paulukuhn, discusses how the company is leveraging the most advanced technologies to support innovation – and ensure that its engineering team remains at the forefront of the industry.

Dr. Leif Paulukuhn heads the global technology development at Siemens' Steam Turbine Business. Since 2014, he has been responsible for developing a leading technological basis for all Siemens steam turbines worldwide, including blading and material technologies. Paulukuhn joined Siemens in 2005, serving in a variety of technical leadership roles. He holds an M.Sc. and a Ph.D. in mechanical engineering and an M.Sc. in business administration from RWTH Aachen University.

DIMENSIONS: Siemens is a longtime leader in the world-wide power generation industry. What changes have you witnessed recently in the industry, and how has Siemens adapted to those changes?

LEIF PAULUKUHN: The global push for greater and greater energy efficiency has forced power plants to function in new ways. As utilities increasingly adopt alternative energy sources such as wind, water and solar, the incoming power supply has become less constant. Plants cycle on and off more frequently, but our turbines must operate consistently and reliably each time they start up. Siemens' product development team must engineer our equipment for volatile operating parameters and shifting thermal conditions that are very different from the past. In addition, our turbines are being pushed to achieve higher performance in an effort to produce as much energy as possible, as efficiently as possible.

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For our company, that means delivering robust, reliable designs that have been verified before they're installed in our customers' plants. After all, in the power generation business, non-conformance cost is high. A widespread outage can not only mean inconvenience, but it can have serious financial implications.

D: What role does product innovation play in meeting these new market needs?

LP: The reality is that the steam turbine industry is relatively mature. Siemens was founded in 1847 and began to focus on power generation in 1946. Today, the company has more than 20,000 turbines installed in power plants around the globe. We have engineered our products very well, which means there is little room for improvement in our core products. Of course, we still do focus on “clean sheet” turbine designs that look toward the future.

When you multiply even small gains across our thousands of customer sites, we are making a huge collective impact on global energy efficiency.



In order to achieve these incremental gains, one of our key strategies has been to identify and leverage the most advanced technologies available to support our product development efforts. Our goal is to capitalize on the best available technologies to understand product performance at a very fine level of detail — then keep improving that performance incrementally.

D: Can you tell us more about your focus on advanced technologies — and how your team applies technology?

LP: Certainly engineering simulation has been an essential tool for Siemens for many years. Most of the highly educated engineers in our steam turbine technology development team are trained in simulation. Why have we placed such an emphasis on simulation? Because it's critical to ensuring product reliability. With so much at stake, we have strong confidence that our turbines will perform as expected under real-world conditions.

Engineering simulation gives our designers the opportunity to predict how our products will work under the diverse, demanding operating conditions that characterize today's power plants. We can even visualize the flows that are happening inside our equipment, which is impossible to achieve using any other means. We can test the impacts of 400 tons of force on our turbine blades, which also would not be possible under any other conditions.

In addition, Siemens leverages advanced technology to gather real-time information on how our thousands of installed turbines are performing in customer plants. Sensors on these machines collect enormous amounts of data on equipment efficiency, uptime and downtime, vibration, temperature and other key performance aspects. By analyzing this data and providing insights to the product development team, Siemens is making continuous improvements in our turbine designs. For example, by understanding actual steam temperature distributions, we have been able to further shorten turbine startup times.



This post-installation technology application is a valuable complement to the simulation exercises that take place before products are sent into the field. Obviously, our simulations will be most valuable if we are setting parameters and boundary conditions that are based on real-world operating data. And, if there are areas of concern that arise from field data, our engineers can conduct extremely targeted simulations to study those specific issues.

D: You've actually defined an organizational hierarchy for your engineering team that rewards technical excellence. Can you talk about that?

LP: In most engineering organizations, there is only one career path and it's a management track. Engineers who perform well in their functional roles are promoted to managing teams of employees performing the same role. So an engineer might start as a computational fluid dynamics (CFD) specialist, then progress over time to managing a team of CFD experts.

However, at Siemens we believe that the mastery of advanced engineering technology is extremely valuable in maintaining our market leadership — and we believe that technical expertise should be recognized and rewarded. While we have a traditional management track, we also have a unique career path focused on technical excellence.

For example, if an engineer demonstrates a real mastery of CFD, then he or she can add the greatest value by remaining focused on CFD — and establishing a “center of excellence” on our team. If any employees are struggling with a CFD challenge, they can take advantage of the knowledge of this high-level expert.

Siemens has found this idea of a technical track very useful in attracting highly skilled employees who can support our future leadership, as well as accelerating our overall product development cycle. With so many experts available on our team, we can rapidly address even the most complex design issues and move forward.

D: Steam turbines are only one component of a power plant — and Siemens provides the full generation system. How do you work together across Siemens to drive innovation via technology?

LP: At the corporate level, we have adopted the same commitment to advanced technology that we embrace in the steam turbines unit. Best-in-class engineering tools and practices, including simulation, are a way of life across our global business. Our executives recognize that we can only maintain our product leadership by providing our engineers with the best available resources.

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As huge volumes of performance data come in from the field — not only about turbines, but about other Siemens products — the company has invested in the IT resources to manage that data. Siemens has also created a dedicated analytics team that identifies the key insights to feed back to our product developers. Data analysis is really essential in order to keep improving the efficiency of our products. We're fortunate to have an expert team devoted to that task.

In many ways, Siemens places a very high value on the newest technologies and leading best practices. This positions Siemens to help our worldwide customers keep up with changing consumer demands and the drive for higher and higher energy efficiency. We have a long history of providing superior product systems, but we're not resting on our past success. Instead, we're really focused on technology leadership across our business, including in our engineering function. It's that commitment to technology and innovation that is positioning Siemens for another 70 years of success in power generation. 

Siemens at a Glance



SIEMENS

2015 revenues: **€75.63 billion**

Number of employees: **362,000**

Headquarters: **Berlin and Munich, Germany**

