

# Staying Flexible in a Changing Energy World

In a world where the impact of environmental regulations varies and where the needs of modern economies are changing, providing clean energy in a reliable way requires innovation and imagination. To meet the needs of such a dynamic global market will require power generation that is not only efficient, but also “flexible.” Randy H. Zwirn, CEO of Siemens’ Energy Service Division, thinks the need for highly efficient and highly reliable clean energy sources is a challenge that can be solved... with solutions available today.

By Joel N. Shurkin

## What exactly does the term “flexible megawatts” mean?

ZWIRN: The power system is a mix of different technologies interacting to meet the total electrical requirements that vary by time of day and type of load (industrial/commercial vs. residential). Some technologies are used to cover the base load, such as nuclear and coal-fired power plants, which typically run with high capacity factors and are not cycled up and down. Other plants powered by gas turbines are primarily used to cover intermediate and peaking requirements, thus allowing the system to follow the load requirements more flexibly. Renewable energy, on the other hand, tends to be intermittent in nature, so the system must be able to accommodate the dynamic aspects of this growing power resource. When the system experiences a new peak load or the need to adapt to changes in wind or solar capacity, it must react quickly to this dynamic environment. In other words, it must be capable of producing “flexible megawatts.”

## Besides that need for flexibility, what market drivers are currently influencing operators’ decisions?

ZWIRN: While load demand has historically been the main driver for new capacity additions, today regulatory and economic uncertainty are also critical drivers for decision making. Although there are different environ-

*Randy H. Zwirn* is the CEO of the Energy Service Division of the Siemens Energy Sector. A native of New York City, Zwirn, 56, holds a degree in economics from Brooklyn College of the City University of New York. He joined Westinghouse Electric Corporation in 1976 and spent most of his career in positions of increasing responsibility within the power generation and energy businesses. From 1996 to 1998, he served as President of the Power Generation business of Westinghouse Electric Corporation. Siemens acquired the Westinghouse Power Generation business in 1998.

Zwirn’s division provides comprehensive services for complete power plants and for rotating machines such as gas and steam turbines, generators, and compressors, as well as for wind turbines, solar power equipment, and emissions control equipment and solutions. The Service Division uses the most advanced plant diagnostics and systems technology. Under long-term maintenance contracts, his division also services and operates power plants.

mental regulatory frameworks in the various markets, there is a growing universal convergence around the impact of global warming. Environmental concerns across the globe are driving the need for increased efficiency with reduced emissions, with a view that eventually the impact of carbon on the economy will be more comprehen-

Photo: Siemens



sively addressed. This results in several technology catalysts that have the potential to transform the energy landscape. First, an ever-increasing drive for improved efficiency in new and existing power plants to derive more megawatts from the same amount of fuel, and at the same time reduce the environmental impact. Second, since approximately 50 percent of our electricity is produced with coal, there have been major steps toward commercializing carbon capture technologies to enable continued use of this abundant resource. Lastly, there will be more renewable energy sources, which by their very nature create challenges of a different kind for the rest of the power system.

#### What will the role of coal be in the future energy mix?

ZWIRN: The global population is growing, raising the demand for electricity. But environmental awareness and a focus on sustainability of the energy conversion chain are limiting the use of certain kinds of fuel – coal, in particular. For example, in the USA, as well as in many other markets in the developed world, it is extremely difficult to get the necessary approvals to build a new coal plant. A significant number of coal plants in the USA are more than 30 to 40 years old, and utility executives are asking themselves

whether it makes sense to make additional investments in their power plants, particularly to add modern flue gas desulfurization and emission control systems, while still facing uncertainty about the possible direction of future environmental policy. Over the next 15 years, more than 30 percent of all coal generation in the USA could be in jeopardy. Many utilities are replacing or planning on replacing coal plants with new, highly efficient natural gas-fired combined-cycle power plants. But other markets, for example China and India, will still depend heavily on coal, so efficiency upgrades for those plants remain interesting from an economic and environmental point of view. The same can be said of nuclear. The upgrades of existing turbine generators and nuclear supply systems over the last five years have already added the equivalent of three or four additional nuclear plants to the system.

#### How do you meet the challenges of environmental standards?

ZWIRN: Despite the global debate over carbon regulation, one position is not disputed: Higher efficiency is the best tool we have today to address the topic. For example, our latest gas turbine, the SGT-8000H series, emits 75 percent less CO<sub>2</sub> than comparably sized coal-fired plants. We also have

gasification and carbon capture technologies that should allow us to use coal in an environmentally compatible way. And, of course, wind and solar power plants will continue to grow in importance.

For the huge installed base of operating plants, the Energy Service Division is focusing on upgrades and modernization to increase efficiency and operational flexibility for the existing operating fleet to make those plants even more valuable to our customers. We have more than 300 GW of operating steam turbines, more than 200 GW of gas turbines, and 11,000 MW of wind turbines in our fleet today. In addition, we have nearly 40,000 units of compressors and industrial-size turbines that are in use in the oil and gas or industrial applications industries. What's clear is that our success is directly linked to our customers running these units!

#### What function will the various power sources play in the short- and long-term future?

ZWIRN: In both the short and long term, we will need a diverse mix of environmentally compatible power generation solutions – there is no single solution or “silver bullet.” That includes coal, natural gas, and nuclear as well as wind and solar power. However, for the next seven to ten years,

natural gas appears to be best positioned to meet the medium-term requirements for new capacity. Renewables will continue to grow, and nuclear, through both life extension and new plant construction, will be an important source of carbon-free base-load generation.

#### How do you make existing plants more valuable?

ZWIRN: Efficiency and flexibility are a winning strategy. One good example is Calpine, one of the largest generators of electricity in Texas and California, and the largest user of natural gas in the USA. They operate 38 Siemens F-Class gas turbines. Although they are fairly modern and advanced machines, new service R&D programs offer the opportunity to enhance plant performance further. We were able to offer this important customer, operating in very competitive markets, a new service upgrade package to increase output of each turbine by 18 MW while improving the heat rate by 1.7 percent, thus providing a payback of the investment in three years – definitely a win-win situation that will likely result in even higher dispatch of the units.

The average efficiency of the US coal-fired operating plant fleet today is 33 to 34 percent. Each 1 percent improvement in efficiency is the equivalent of reducing CO<sub>2</sub> emissions by 50 million tons, or taking 7 million cars off the road. Similar results hold true in other parts of the world as well. An example is the Drax Power Station in North Yorkshire, the largest and cleanest coal plant in the UK, which produces 7 percent of the UK's power. We recently replaced existing high-pressure and low-pressure components with new high-efficiency components. With this upgrade, our customer achieved an increase in the overall efficiency of 4 percent, saving 1 million tons of CO<sub>2</sub> each year, or the equivalent of taking 140,000 cars off the road in the UK.

Given today's dynamic electricity market, we also are developing service

solutions designed to improve the dispatchability and competitiveness of our customers' existing plants. To this end, customers need to be able to increase operating flexibility while maintaining environmental performance so they can take full advantage of the market's economic opportunities. For example, the low-load CO retrofit allows customers to operate their existing plants down to a 50 percent load while still meeting CO emissions limits. This enables them to remain online during lower power demand periods, but at the same time remain available to ramp up when power demand increases. The low-load CO upgrade also helps customers avoid plant shutdown/start-up costs, increase combined-cycle efficiency at part load and reduce total start-up emissions – again, making the existing installed fleet even more flexible and valuable in the new dynamic market.

A continuous focus on innovation is behind these improvements. R&D is a critical component of our service business model because it adds value for our customers and differentiates us from our competitors. We will continue to invest in developing the innovative solutions that differentiate us as an OEM supplier and make our customers' investments more valuable. At the core of what we are discussing today is how we can bring advanced technologies, combined with outstanding field service execution, to the operation of our customers' plants faster and for 30-plus years!

#### How about renewable energy plants?

ZWIRN: Siemens has had great success in renewable energy, particularly wind turbines. Today we have a global installed base of more than 11 GW of wind power, and it's growing rapidly. Our service concepts offer our customers the opportunity to increase wind capture and generate more electricity from their existing plants. Today, with minor modifications to the existing wind turbine blade design, we can increase annual energy generation by

## Glossary

- **Flexible Megawatts:** The idea of having multiple sources of energy so that when one of those sources – for instance, renewables such as wind – is not available, other sources such as natural gas fill the gap.
- **Base-Load Power Plants:** Generators that are either on or off, with no intermediate function. Coal and nuclear power plants are examples.
- **Peaking Technologies:** Generating systems that can start quickly and flexibly vary power output, such as gas turbines.

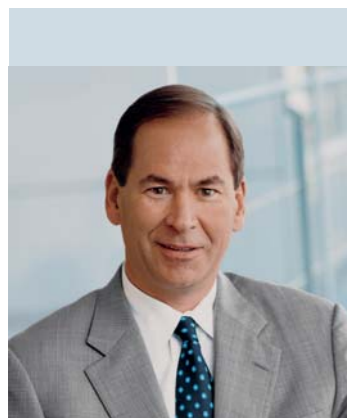
1.5 percent. Remote monitoring and diagnostics is another enabler to make renewable wind energy both more flexible and valuable. About 75 percent (or about 3,500) of all the Siemens wind turbines are being monitored around the clock, and 75 to 80 percent of all issues can be resolved remotely, which means more clean wind power is available to meet the demand. The large fleet of wind turbines being built around the world is another exciting opportunity to apply what we have already learned from our experience on the fossil and nuclear fleet.

#### Mr. Zwirn, thank you very much for this interview.

*Joel N. Shurkin is a freelance science writer based in Baltimore, MD, USA. He won a Pulitzer Prize as one of three lead writers in the Philadelphia Inquirer coverage of Three Mile Island.*

#### Further Information

[www.siemens.com/energy](http://www.siemens.com/energy)



“Improving the efficiency of US coal plants by 1 percent is the equivalent of reducing CO<sub>2</sub> emissions by 50 million tons, or taking 7 million cars off the road.”

Randy H. Zwirn, CEO Energy Service Division, Siemens Energy Sector

Photo: Siemens