

# A New Era in Fossil Power Generation

The future role of fossil energy is often questioned. But the remaining huge reserves of gas and coal will likely continue to be needed. A smart mix of clean fossil fuels and other sources is required. Michael Suess, CEO for Fossil Power Generation at the Siemens Energy Sector, discusses his vision for the future energy mix and the tools that will make it happen.

By Peter Allegretti

One could be forgiven for thinking that fossil fuels are dinosaur fuels, destined to extinction at a time when renewable energies are grabbing the headlines. However, research by Siemens predicts that, even in 2030, fossil fuels will continue to dominate the global energy mix. As new technologies allow for cleaner and more flexible energy, we are entering a new era of intelligent fossil fuel power generation.

In order to explore this concept further, I travel to Siemens' offices in Erlangen, Germany, to meet the man in charge. Michael Suess, CEO for Fossil Power Generation at Siemens Energy, welcomes me with a firm handshake and friendly smile. A seasoned engineer by trade, he is naturally well-versed in his subject and thankfully manages to communicate his extensive knowledge without an excess of technical jargon. Suess makes it clear that in real terms, the amount of

gas, coal and oil needed to power the world's businesses and homes will actually increase. "Fossil fuels are the backbone of the energy mix," he says. "Even with all the renewable energies that are becoming increasingly important, fossil fuels will continue to constitute the main source of the world's power generation."

At the same time, fossil fuel generation is becoming greener, thanks to new technologies that are cleaner and more efficient. Suess believes that the old image of inefficient fossil fuel power generation is largely based on old technology. "If you consider that power plants operate on a 30-year life cycle, many of the plants you see today are based on technology from the 1950s, 1960s and 1970s," he says. "You can do a lot to increase efficiency with modification upgrades over the life span of that plant. But now, we are introducing a new generation of power plant into the market."

This new generation includes technological advances being deployed around the world today. For example, the new E.ON combined-cycle power plant in Irsching, Germany, uses the world's most efficient gas turbine and boasts an overall efficiency of more than 60 percent. Suess highlights the environmental benefits of high efficiency and its greater potential impact on a global scale. "If I could spread that technology and replace all fossil plants worldwide – steam, coal-fired, and gas-fired – I would reduce the CO<sub>2</sub> emissions by two-thirds," he exclaims. "Can you imagine? We're not talking about an untested green technology or what could be available in 20 years' time. It is possible now. That's the reality."

## A New Image for Coal

Integrated gasification combined-cycle (IGCC) power plants are also being developed that use not only natural



Photo: Markus Tedeskindo

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gas, but also coal and other fuel sources. These plants are able to capture carbon dioxide before combustion using existing technologies. A modern coal-fired power plant can attain an efficiency level of 47 percent, a substantial improvement on old coal-fired plants, which operate at an average of about 30 percent. “Just with that,” says Suess, “you could reduce the CO<sub>2</sub> emissions worldwide by one-third.”

These efficiency levels are now being evidenced in China, a country rich in coal reserves and home to one of the most technologically advanced

coal-fired power plants in the world. The Waigaoqiao III plant in Shanghai, which began operating in 2008, achieves nearly 47 percent efficiency through the use of ultra-supercritical technology operating at temperatures of 600 degrees and above. For the Chinese, Waigaoqiao represents a financial and political investment as well as a commitment to build cleaner fossil-based power plants to power the nation’s rapidly growing infrastructure. In a perfect world, every government and power company would choose the latest low-emission, high-efficiency

technologies and continually renew its existing plants. The reality, of course, is that financial constraints, national spending priorities, natural resources, politics and public opinion all shape a country’s energy strategy. While some European governments are looking to nuclear and renewable power to supplement their energy needs, countries in the Middle and Far East are looking to fossil fuels. India is planning to build more power plants using subcritical technology – operating at 520 degrees. Suess would like to see India leap ahead to the next generation. “The goal is always to find ways to increase efficiency. The less coal you burn, the more resources you keep, and the less CO<sub>2</sub> you emit.”

### Getting the Right Mix

Although fossil fuels will remain the backbone, Suess forecasts a “mixed economy” in energy terms – a coexistence of fuel sources where gas, coal and oil will combine with wind, solar, biomass and hydro as well as nuclear power. “There’s no competition between fossils and renewables. It’s not a question of an ‘old economy’ and a ‘new economy.’ They will both be suc-

cessful in the wide energy portfolio because the secret is actually to have the *right* portfolio.”

Getting the right mix of renewable energies, fossil fuels and other sources is the key – achieving a so-called “intelligent mix” of energy sources that can be flexible enough to meet increasing demand, allow for variation throughout the day, keep customer costs low, and take environmental factors into account. Gas-fired power plants have the advantage of being quick to fire up and meet peak demand, while renewable energy sources can serve to round out the “intelligent mix.” This mix will require a new kind of grid network that is more dynamic than the current static network. So-called “smart grids” would allow management and delivery of the fluctuating energy supply generated from the variety of energy sources and make most efficient use of renewable power when it is available.

At present, renewable energies account for about 3 percent of the world’s energy portfolio and are estimated to rise to 17 percent in 20 years’ time. Meeting this increase will take continued investment and sustained effort. “To raise renewables even to 17 percent in 2030, we need an investment of 3,000 billion US dollars,” says Suess. He adds that it is presently much less expensive to invest in a gas plant than in a wind turbine plant: The capital cost per kilowatt for a gas plant is about 500 to 700 euros, whereas with wind power, it ranges from 1,000 to 1,100 euros for onshore and from 2,400 to 3,000 euros for offshore. On the other side of the equation, Suess points out that while there are fuel costs associated with gas, there are none with wind.

Of course, it’s not only a question of cost or of preference, it’s also about the environment. Scientists have called for global warming to be kept to a maximum of 2 degrees. So how does Siemens square the new generation of intelligent fossil fuel generating plants with calls to control global warming through reduced emissions?

Photos: Markus Tedeskin

“With a modern combined-cycle power plant, the CO<sub>2</sub> emissions are roughly 330 grams per kilowatt-hour,” says Suess. “If you take into account global warming levels, where 500 grams per kilowatt-hour assures staying within the two-degree limit, whatever is below 500 grams per kilowatt-hour will support that. The new Irsching combined-cycle power plant is well below that limit. We have low NO<sub>x</sub> and CO<sub>2</sub> levels, we have enough gas, and it’s extremely flexible to operate because ramp-up and cycle times are quick,” says Suess. “Also, with gas plants, you can add whatever energy you get from renewables. So if the wind is blowing, you can turn down the gas.”

### What’s Next?

There are other technologies in the pipeline too. With carbon capture and storage (CCS), Siemens is refining a second generation of postcombustion technology now being piloted using amino salts, which draw CO<sub>2</sub> from the exhaust gases. Electricity storage, a vital component for the future of energy, is still in its early stages and is a key area of research and development. Even with coal, Siemens is setting the bar higher – to reach efficiencies of more than 50 percent using 700-degree steam power plants. This technology could lower CO<sub>2</sub> emissions by 25 percent. And the new Siemens gas turbine SGT5-8000H in a combined-cycle power plant (CCPP) will deliver efficiencies of more than 60 percent. Research and investment are vital to develop these new technologies and make them cost-effective. “We at Siemens are investing heavily,” says Suess. “In my division, 350 to 400 million euros are being spent every year on R&D. These technologies don’t come overnight. The last gas turbine took more than seven years to develop, and then another six to seven years until reaching break-even. So it’s 10 to 15 years from start to finish – and only those companies that can sustain such investment will stay in the business. This is why, especially in gas, it’s such a high hurdle. The hurdles are

so extreme, the technology challenges are so high, that you have to be constantly engaged. And due to the high market-entry barriers, there are only a handful of competitors in the market. Siemens can offer the technology tools, but ultimately, it is up to governments and society to decide whether they use these tools or not.” Suess says the relatively modern idea of cleaner energy started with a goal and a vision, which through investment and research is now becoming a reality. “We must leave no stone unturned,” says Suess. “I want my children to have the same opportunities I have had for a good environment – clean water and air. We have the technologies to make great improvements to the environment now.” The issue is persuading people and countries to invest in cleaner, more environmentally friendly, “intelligent” ways to use fossil fuels to meet the planet’s growing demand for energy.



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### Further Information

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