

## Optimizing Power Plant Operations for Increased Profitability

Siemens is helping its industry partners draw increased performance and heightened profitability from existing power plants, while often extending their lives. So much so that Siemens is looking to put its money where its mouth is.

“Our new instrumentation & controls (I&C)-based process optimization solutions tune power plants to respond more nimbly to market conditions,” explains Bernhard Meerbeck, Head of Process Optimization at Siemens Energy. “The new agility almost always has an overwhelmingly positive impact on a plant’s flexibility, life span and, thus, profitability.”

The majority of extant power plants were constructed for operating conditions much less treacherous than those they contend with today. Process opti-

mization often attains significant increases in operational flexibility by improving a plant’s agility. It does, however, necessitate thorough research into a plant’s idiosyncrasies. “In order to reach optimal results, we need to be thoroughly familiar with the behavior of a plant,” explains Meerbeck. “Only then can we select the solutions that enable a plant to better cope with the challenges it faces.” Siemens is so convinced of the results of process optimization that it has begun to offer related value-based contracts. The new contracts outline a mandate reference benefit and a bonus/malus system, directly aligning compensation levels with the additional value made possible by process optimization. “I&C-based process optimization is very powerful and often

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Head of Process Optimization  
at Siemens Energy

surpasses all parties’ expectations,” says Meerbeck. “And the new contracts enable us to literally put our money where our mouth is in terms of its benefits, so to speak.”

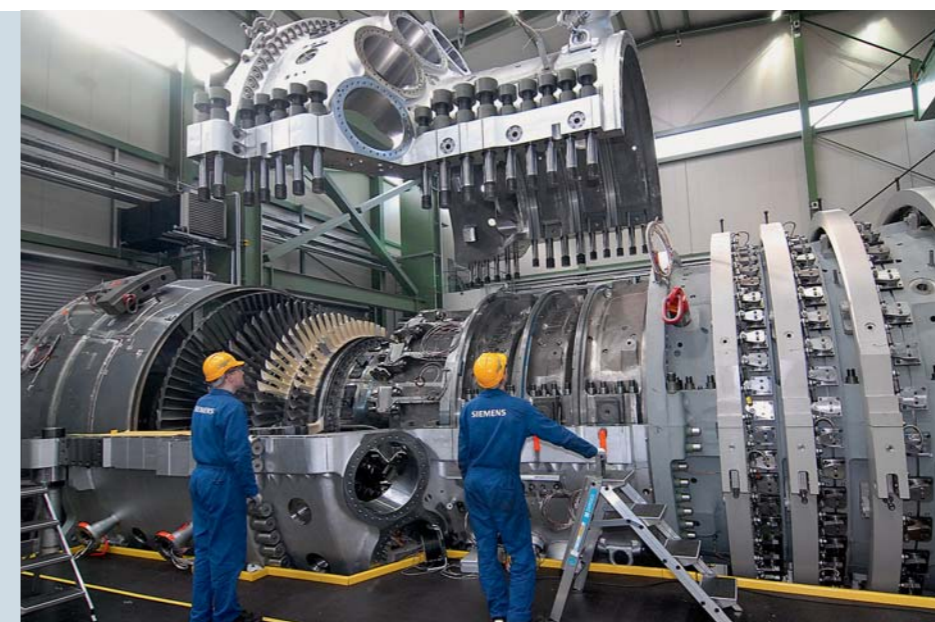
## Eco-Friendly Overhead Transmission Lines in Brazil



High-voltage lines tower above the rainforest canopy for minimum impact to the delicate ecosystem below.

In early 2008, Siemens was contracted to build the high-voltage substation of the Salto Pilão hydroelectric power plant in Brazil’s Santa Catarina state, as well as two 138-kV transmission lines that now supply power to over a half-million people. The project came with huge challenges: the transmission lines would run through the Floresta Atlântica, a tropical rainforest that is home to one of the most diverse ecosystems on the planet. Unique solutions were needed to ensure minimum environmental impact. Defores-

tation had to be strictly avoided. All of the work, including transportation of materials, laying of cables and construction of towers, was done manually. This was necessary not only because of the dense vegetation and irregular terrain, but also – primarily – to protect the forest’s more than 25,000 species of fauna and flora, many of them threatened with extinction. The successful completion of this project underscores Siemens’ technical competence in and commitment to providing solutions that respect the environment.



More power, less environmental impact: the 50-Hz SGT5-8000H gas turbine, now also offered for 60-Hz markets.

## Environmentally Friendly Technology of SGT-8000H Gas Turbine for 50 and 60 Hz

### Climate and Environment Prize for Innovative Gas Turbine

By developing technology with the environment in mind, Siemens is capturing not only new markets, but also wide recognition in the energy industry. The 50-Hz SGT5-8000H has already successfully proven its high performance in operation, taking top honors at the inaugural Innovation Prize for Climate and Environment (IKU) awards in February of this year in Berlin, Germany. Siemens was honored in the “Green Products and Services” category for the most efficient gas turbine in the world. The prize was awarded by German Environment Minister Norbert Röttgen and Federation of German Industries Director General Werner Schnappau.

The SGT5-8000H will be the centerpiece of a combined-cycle power plant (CCPP) operated by E.ON in Irsching, Germany. The turbine of superlatives is more than 13 meters long, 5 meters

high, and – at 440 tons – weighs more than the largest passenger airplane built today. On its own, the gas turbine generates 375 MW of electricity. Once it is connected with a steam turbine, output will rise to 570 MW, an amount sufficient to meet the electricity needs of some 3.4 million people, approximately the entire population of Berlin. The plant will achieve a world record efficiency level of more than 60 percent, which will benefit both the environment and the climate: annual CO<sub>2</sub> emissions from each new plant of this type will be about 700,000 tons below the average emission level for power generation worldwide – a reduction equal to the total emissions of 350,000 cars driven 15,000 kilometers a year.

### SGT-8000H Gas Turbine Available for 60-Hz Markets

The environmentally friendly technology of the SGT-8000H is now also available for 60-Hz



L. to r.: Michael Süß, CEO Fossil Power Generation, Siemens Energy; German Environment Minister Norbert Röttgen; and Bernhard Fischer, Member of the Managing Board of E.ON Energy at the IKU awards ceremony in Berlin, Germany.

version gas turbine generates 274 MW in simple-cycle operation and over 410 MW in combined-cycle operation – with an efficiency of more than 60 percent. The patented, active-clearance control technology of SGT-8000H puts flexible operation into the hands of the operators with fast-start capability, rapid load change, and part-load operation.

Photos: Siemens

## World's Most Powerful HVDC System in China

In December 2009, Siemens put the first pole of an 800-kV high-voltage direct current (HVDC) system into operation in China – a project of enormous scale and magnitude. The 1,400-kilometer-long Yunnan-Guangdong system is currently the world's most powerful of its kind and sets new benchmarks in energy-efficient transmission of eco-friendly electricity.

Commissioning of the second pole – which will complete the system – is scheduled for mid-2010. First pole commissioning was originally set to provide a transmission capacity of 2,500 – 5,000 MW when both poles are in operation – but since the former is an unlucky number in China, the capacity was bumped up to 2,600 MW. In its partnership with the utility China

Southern Power grid, Siemens designed the HVDC system and supplied the core components, which included 800-kV and 600-kV transformers, converter valves, DC filters and 800-kV direct-current components. The project has been honored with the Power Asia Award.

HVDC in China: power on a large scale from Siemens.



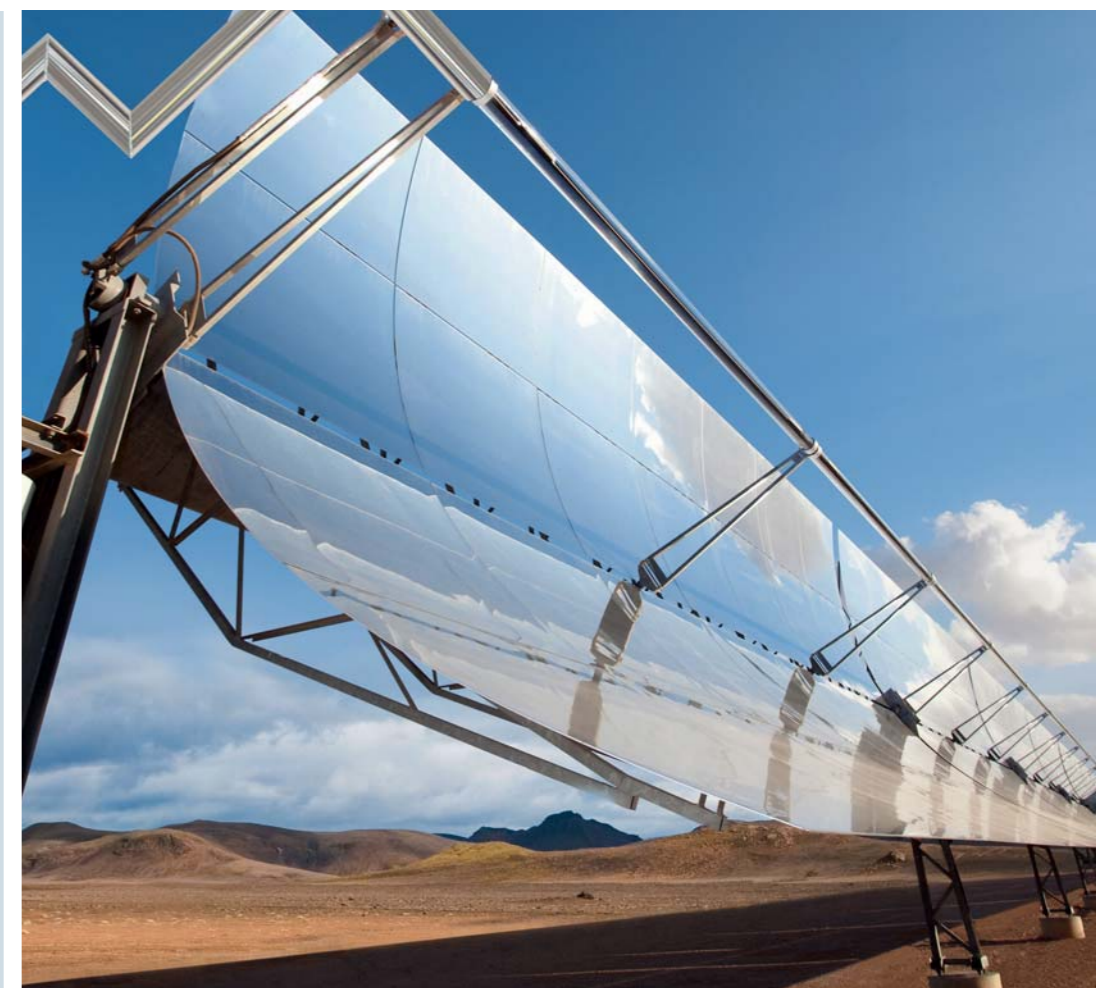
## Keystone Oil Pipeline: a Complete Solution

With the opening of the 3,456-kilometer Keystone Pipeline in February of this year, Siemens marked an important milestone in its evolution from a product supplier to a solutions provider and system integrator in the oil and gas market. The pipeline now supplies North America with up to 590,000 barrels of crude oil per day, stretching from the huge feed-in station in Alberta, Canada, all the way down to Illinois and Oklahoma in the United States.

For this large-scale project, Siemens delivered a complete package that included 37 complete pump stations and the associated distribution systems, as well as 19 high-voltage substations, including transformers, to ensure that the pumps have a steady supply of power.

The operator of Keystone, TransCanada pipelines, has already commissioned Siemens as a solutions partner for a follow-up project of similar magnitude that will extend the pipeline system even further.

Photos: Siemens



The new UVAC 2010: enhancing cost-effectiveness for solar thermal power plants.

## Bright New Horizons for Solar Energy

Siemens acquired the successful Israeli company Solel Solar System Ltd in October 2009. Now Siemens is in a unique position to offer solar thermal products, system solutions, and plant solutions, including key technologies like the solar receiver or the steam turbine. The company is now operating under the name Siemens Concentrated Solar Power Ltd.

This further expansion of Siemens' environmental portfolio will allow it to strengthen its market position in the promising business of solar ther-

mal power plants. Thanks to this new partnership, Siemens has already released the UVAC (Universal Vacuum Air Collector) 2010, the further development of the best-selling UVAC receiver, which is the key component for the solar fields of parabolic-trough power plants. The UVAC 2010 features extremely high solar absorption, reduced heat loss, and an enlarged active area, significantly increasing the cost-effectiveness of a solar thermal power plant and also reducing operating costs.

## New Direct-Drive Wind Turbine: a Technological Breakthrough

Siemens' first prototype of a newly designed direct-drive on-shore wind turbine, the high-performance SWT-3.0-101, is now in operation in Brande, Denmark. The name of this gearless, next-generation machine refers to its power rating of 3 MW and its 101-meter-diameter rotor blades. The commercial version will be introduced to the market later this spring. The SWT-3.0-101 has only half the parts of a standard geared wind turbine, which can reduce maintenance time significantly, resulting in even higher turbine availability. Its main advantage is increased efficiency, even at low loads, thanks to a new, compact permanent-magnet generator – a simple design that requires no excitation power, slip rings, or excitation control systems.



The SWT-3.0-101's gearless nacelle means low maintenance, high efficiency.

The new SWT-3.0-101 machine being erected in Drantum, near Brande, Denmark.



## Low-Noise Transformers: a Powerful Whisper in the Big Apple



New York City – the Big Apple – and neighboring Westchester County are home to over 9 million people. Obviously, the lighting and power needs of such a large population are huge. In some areas, load density equals >2,000 MW per mile. Compact, efficient low-noise transformers are a must under conditions like this. The utility that serves a total of 3.2 million electric customers in New York and Westchester County is Con Edison,

a conglomerate tracing its origins back to the late 19<sup>th</sup> century, when Thomas Edison developed the first complete system of electric generation and distribution. Today, Con Edison operates one of the most complex – and reliable – electric power systems in the world. But in recent years, in order to accommodate urban area load growth, the company has had to move many of its stations into urban areas, creating new challenges with land requirements, equipment size, transportation and transformer noise levels. Then, in 2003, New York City revised its noise code, lowering permissible decibel levels substantially inside commercial and residential areas.

Con Edison contacted Siemens (who had already been providing the company with transformers since 1982) with a challenge: to develop an efficient, compact, low-noise transformer with the same space requirements as the old one. Siemens came up with a solution that is not only in line with the regulations, but stays well below the new limits on noise. Since 2003, the Siemens factories Weiz, Nuremberg, and Linz have delivered 77 new low-noise transformers in the range of 65 MVA up to 420 MVA to locations around the city, each with an average sound pressure level of between 49 dB(A) and 58 dB(A) – roughly the equivalent of the noise produced by a refrigerator or chirping birds at the low end, or a main street at night on the high end. The result: happy residents and happy energy customers.

## Remote Field Assistance for Power Plants

Siemens Energy Field Service has a new remote field assistance (RFA) system. This field service tool offers improved service quality worldwide for the installation, start-up, assessment, troubleshooting and maintenance of complex power plants. With the RFA system, the on-site service technician can communicate in real time – hands free – with a service expert from the Siemens Service Competence Center in Berlin or elsewhere in the world via a telephone headset, a special display attached to his helmet that shows photos or videos, and a small computer that he

carries in his pocket, allowing wireless, encrypted transmission of data. “The RFA system ensures a consistently high level of service quality even in countries with travel restrictions, and helps Siemens experts decide on a further course of action without losing any time,” says Volker Heblinski, Project Manager for Research and Development for gas turbine service components.

The technician carries the tools for the new remote field assistance system – cameras, display and computer – right on his person, leaving his hands free.



Photos: Siemens, Illustration: Orlando Illustration