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Overcome modern challenges in power reliability

In the chemical industry, unscheduled downtime means costly schedule disruptions and reputational and financial loss. Chemical producers, however, face growing threats of cyber attacks as they digitalize operations. They also face persistent skills shortages, as much of the current workforce moves into retirement and a new generation must provide maintenance on what in many cases is aging infrastructure. Maintaining sufficient on-site power, environmental and personnel safety, and regulatory compliance are persistent challenges in the chemical industry.

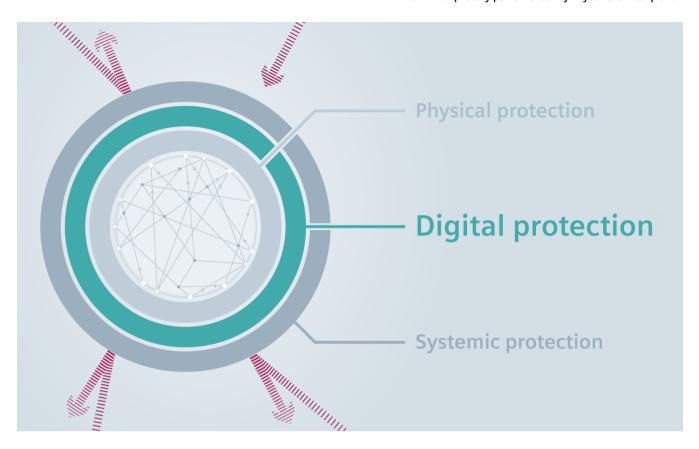
Siemens' broad portfolio of solutions and services can help overcome these difficulties to deliver reliable electrical power. Chemical companies around the globe rely on Siemens solutions to:

• Digitalize operations to increase profitability

- Upgrade and maintain assets
- · Augment workforce skills
- Ensure adequate power
- Protect personnel and the environment
- Harness the power of big data
- · Stay compliant

Maintaining a safe, reliable and efficient power supply is critical to protecting your business, your workers, and the environment.





Enable secure digital transformation

Digitalizing chemical operations has been proven to help increase profitability: 3.1% additional annual revenue is typically achievable using advanced digitalization. Digitalization can expose aspects of plant operations and data transfer to cyber attacks.

Siemens can provide solutions to help ensure a secure digital transformation. Siemens-exclusive protective relays, specially designed to protect your communication network with embedded secure boot mechanisms and cryptographically protected access, help maximize supply security, from arc flash mitigation and capacitor bank protection to voltage control and safeguards for motors, generators, software and more.

A comprehensive cyber security plan is critical to protecting your operational technology (OT). Siemens cyber solutions help you build your OT cyber readiness in three essential areas: assess and plan, protect, and detect and respond.

For chemical companies seeking smarter platforms and equipment, Siemens offers solutions that enable standard switchgear to be both programmable and self-monitoring, combining the best of advanced switchgear technology, protective relay products and expert engineering experience.

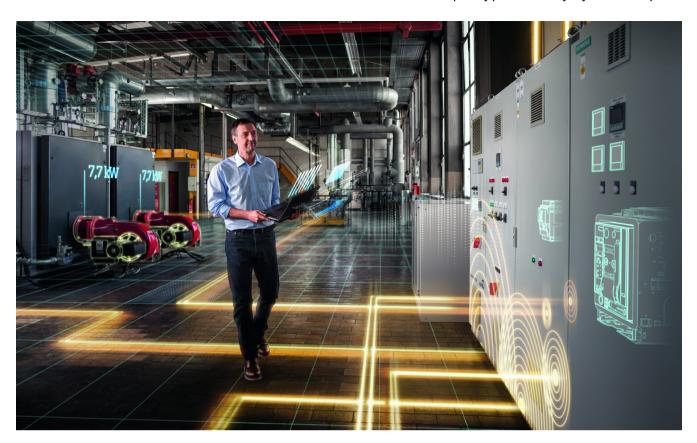
Chemical companies using

digital programs to drive strategic decisions.² Butachimie, a large chemical

Butachimie, a large chemical plant in the Alsace region of France, relied on Siemens simulation software for a smooth and efficient digitalization of their complete process-control system.

¹ PwC, "Industry 4.0: Building the digital enterprise - Chemicals key findings," 2016.

² PwC, "Industry 4.0: Building the digital enterprise -Chemicals key findings," 2016.



Upgrade infrastructure without disruption

An aging plant infrastructure represents an ongoing challenge in maintaining operational uptime. Reliable, modernized electrical equipment and power is critical. Plants need ways to update, replace and, in some cases, retrofit their equipment to control capital costs. The key? Updating the infrastructure with minimal interruption to operations.

Siemens offers standardized designs for equipment such as circuit breakers, switchgear and protective relays, enabling modular upgrades that avoid the cost of complete replacement or operational disruption.

Siemens low-voltage replacement circuit breakers and/or medium-voltage vacuum replacement circuit breakers provide a cost-effective way to upgrade to current technology while increasing equipment reliability and minimizing downtime.

In addition, Siemens protective relays can be upgraded with a single software package. The Siemens portfolio includes modern gear designs that deliver more power but require a smaller footprint, as well as pre-fabricated power equipment centers that can be built off-site and shipped ready to operate, for faster project turnaround.

To help manage capital expenses, Siemens offers project financing, equipment and leasing solutions, structured financing, capital loans and advisory services.

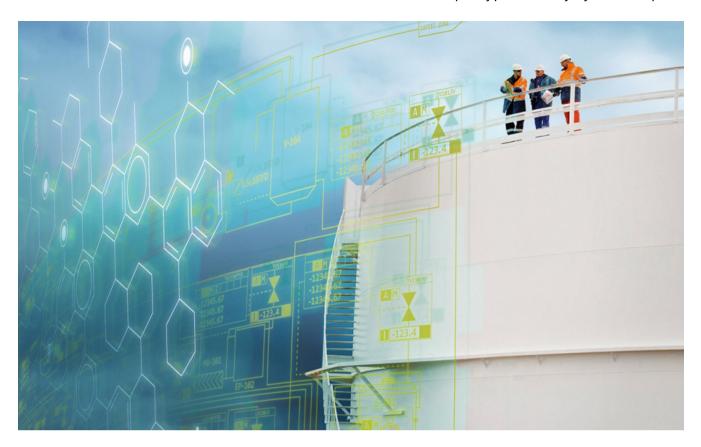
Additionally, Siemens offers services, modernizations and upgrades to keep power generation assets operating reliably with maximum uptime, and even match service intervals to your overall production schedule.



A prefabricated substation provided a plug-and-play solution for a plant in France.



Learn how Siemens FlexLTF services helped Profertil increase production and efficiency.



Shore up skills gaps with specialized technology

The chemical industry can expect to lose 20 to 40 percent of its workforce in the next three to five years due to retirement.¹ How can chemical companies capture those employees' accumulated knowledge and share it with a new generation of workers who are expected to maintain both new and old equipment? Employee training is costly—but so is downtime due to human errors or simple lack of skills.

To share that accumulated knowledge, Siemens offers traditional classroom training courses as well as integrated plant management software that uses immersive virtual reality capabilities to reduce training and operation costs. Siemens maintenance offerings and services can help remove the burden of skills shortages. And investments in gear that leverages intelligent systems help enhance data collection, predict maintenance needs, and reduce operational costs.

78% Retention rate increase that can be achieved using 3D visualization and virtual reality in training.²

Accenture, "The North American Chemical Industry: Building a Workforce for Tomorrow," 2016.

² Siemens, "How New-Generation 3D Visualization Technology Will Transform The Workforce Of Tomorrow," 2018.

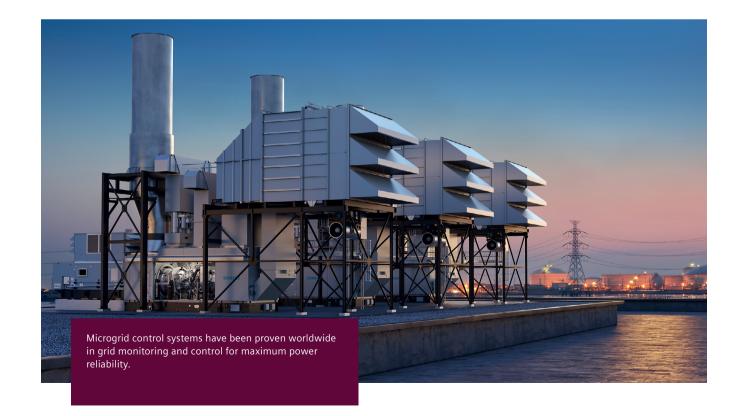
Maintain on-site power

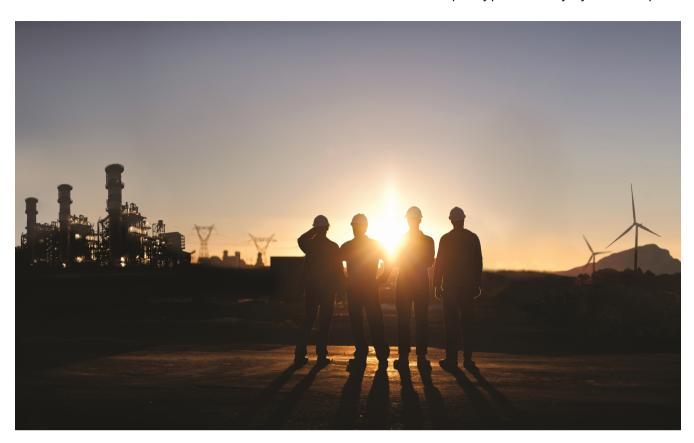
To avoid unscheduled downtime for processes that demand high and sustained energy inputs, chemical plants must ensure a reliable and resilient source of power. On-site energy generation, energy storage and/or mobile substations are key to maintaining continuous plant operations.

Siemens helps chemical companies take control of their power supplies. Distributed Energy Systems (DES) and microgrid control systems work together to meet facility power requirements while using the most cost-efficient sources to minimize plant disruptions. DES addresses a range of needs

including: targeted use of renewable energy, combined heat and power solutions, or provisioning of storage solutions all the way to providing energy-as-a- service. Microgrid control systems address the needs of plants that require autonomous power supplies, such as those with grid islanding capability. To meet the need for reliable, affordable, and efficient on-site power generation, Siemens provides a broad portfolio of gas and steam turbines, generators, and integrated distributed control systems.

EuroChem, one of the world's leading mineral fertilizer producers, looked to Siemens to build a main substation for backup power. Today, the Kama-Potash substation is one of the premier substations in the Perm region of Russia—equipped with state-of-the-art transformers, switchgear, relay protection, and automation.



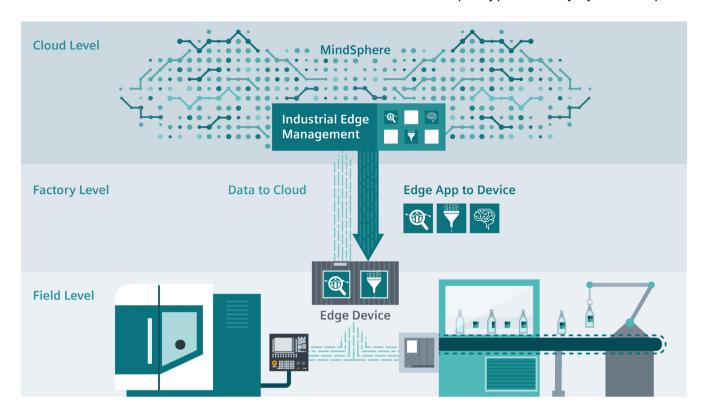


Put environmental and human safety first

Whatever risks present themselves— whether a leak into a local water source or an arc flash that harms an employee— maintaining plant safety is paramount in protecting your company from reputational damage, fines, lawsuits, or complete operational shutdown.

To prevent such occurrences, Siemens offers process instrumentation solutions that include intelligent electrical devices connected to secure networks, as well as the ability for switchgear operators to interact with equipment using a remote interface, to avoid direct personnel contact with electrical gear. In addition, Siemens transformers are specially designed to withstand the most rugged environmental conditions and to meet the highest safety standards, including:

- ISO 9001, 14001 for certified plants
- IEC 60076-1 for power transformers
- IEC 61378-1 for converter transformers and as an additional standard for transformers for industrial applications
- IEEE Std C57.12
- IEEE Std C57.17



Power reliability demands advanced monitoring and protection

Staying ahead of potential outages requires superior monitoring and protection—and today, that means chemical companies need the ability to leverage big data and apply advanced analytics.

Siemens provides software solutions, intelligent hardware, and Internet of Things (IoT) platforms that help do just that, so organizations can better monitor plant efficiency, make critical decisions to reduce expenses, improve operational efficiency, and effectively manage overall power consumption.

Siemens' cloud-based, open IoT operating system connects products, plants, and machines, to harness data generated by IoT devices with advanced analytics. Powermonitoring software, integrated into the operating system, can further increase energy optimization, as can plant-assessment solutions, smart metering, and strategically placed protective relays. Intelligent monitoring equipment can identify potential points of failure before they cause a disruption.

Increase process safety while reducing risk

In the chemical industry, process safety and compliance are firmly intertwined.

Siemens solutions support sustainability at every phase in the product lifecycle, including eco-design initiatives. By reducing costs, surpassing regulatory requirements, and serving as responsible corporate citizens, companies can grow their business sustainably while fostering a culture that promotes innovation and "doing the right thing."

Our solutions can help reduce risk and increase process safety, and a full range of services is ready to assist with everything from repairs and plant modernization to expert consultation.

Madrid-based Gestamp, one of the world's leading component suppliers to car manufacturers, installed Siemens' big datadriven energy efficiency platform to optimize the energy consumption of its 14 European factories, and consequently reduced CO2 emissions by 15 percent. Gestamp saved almost 45 Gwh in just 12 months, for a projected total return on investment of less than three years.



