

SmartProcess™

Optimization Technology for Power Generation



AEP

AES

Alabama Electric Coop.

Alliant

Ameren

Consolidated Edison

Constellation Energy

Dairyland

Duke Energy

Dynegy

EEl

Entergy

Florida Power & Light

Grand River Dam Authority

KCP&L

KOSEP

MidAmerican

Minnkota

NV Energy

PacifiCorp

Polska Grupa Energetyczna (PGE)

Progress Energy

Public Service of New Hampshire

SASK Power

Tampa Electric (TECO)

We Energies

Western Farmers Electric Cooperative

Xcel Energy

Emerson Process Management leads the plant optimization industry with proven results, years of experience in the design and implementation of advanced control technologies, and, most importantly, a long list of satisfied customers.

For decades, we have been the recognized leader in control technologies for improving plant performance. Our customer-based strategies and value-driven focus, as well as an intense and unwavering concentration on our core industries, have allowed Emerson to consistently lead the market by helping our customers achieve continuous process improvement with state-of-the-art applications for power plants.

Optimization technology is widely accepted as being a cost-effective solution that demonstrates dramatic performance improvements. To date, hundreds of customers around the world have benefited from SmartProcess™ optimization technology.

Dramatic Optimization Results



With increased market competitiveness and a growing concern for environmental stewardship, utilities, particularly fossil-fuel-burning power producers, face an array of issues including environmental management, operational flexibility, unit performance, fleet management, and fiscal responsibility. Finding a balance for these seemingly conflicting matters is the most challenging issue facing power producers today.

SmartProcess™ optimization technology from Emerson offers adaptive improvement solutions to help utilities achieve optimized equipment performance for emissions compliance, temperature control, efficiency, and overall continuous operational improvement.

SmartProcess incorporates fuzzy logic, advanced analytics, and model predictive control developed specifically for the needs of our customers to offer the most advanced suite of optimization solutions available.

By building plant-specific models to simulate process variations and changing load levels, SmartProcess identifies the precise control settings for continuous optimal performance. The plant model incorporates self-learning features that allow SmartProcess to adapt

to long-term changes in the plant. SmartProcess uses a truly dynamic approach that balances a plant's multiple objectives and varying conditions to optimize and improve plant processes, regardless of size or configuration.

Each solution dynamically optimizes its targeted processes, sending new setpoints and biases directly to the control system — even as the plant ramps to meet market and grid demands. SmartProcess can also operate in advisory-only mode, alerting operators to changing settings and taking actions to achieve targeted objectives.

SmartProcess can be integrated with any suppliers' control system or deployed using other technologies, such as PI by OSIsoft™ or the open industry standard OPC protocol, and its non-invasive implementation process is conducted without any outage.

Each SmartProcess solution improves efficiencies throughout the process by targeting specific areas. For example, SmartProcess solutions:

- Minimize forced outages for increased availability and less stress on boiler tubes and turbine components
- Improve load flexibility by increasing ramp rates and decreasing startup times and minimum load
- Reduce heat rate through boiler efficiency and spray flow reduction
- Reduce NOx, CO, and opacity emissions
- Improve fleet management capabilities
- Optimize plant environmental equipment such as scrubbers
- Improve the efficiency of unique combustion processes such as those of cyclone and fluidized bed boilers

Improve plant processes and profitability

SmartProcess Benefits



SmartProcess Combustion Optimization

- Improves heat rate
- Reduces emissions
- Controls opacity levels

SmartProcess Fluidized Bed Optimization

- Achieves stable boiler operation
- Reduces emissions
- Tracks performance variances
- Achieves ideal SO₂ absorption rate

SmartProcess SCR Optimization

- Lowers operating costs
- Maintains optimum temperature and pressure

SmartProcess Unit Response Optimization

- Improves unit stability
- Increases ramp rates
- Increases startup efficiency

SmartProcess Steam Temperature Optimization

- Improves ramp rates
- Minimizes temperature variations

SmartProcess Economic Optimization

- Optimizes heat rate across multiple units
- Optimizes varying cogeneration electricity and steam demands
- Reduces maintenance costs

SmartProcess Sootblower Optimization

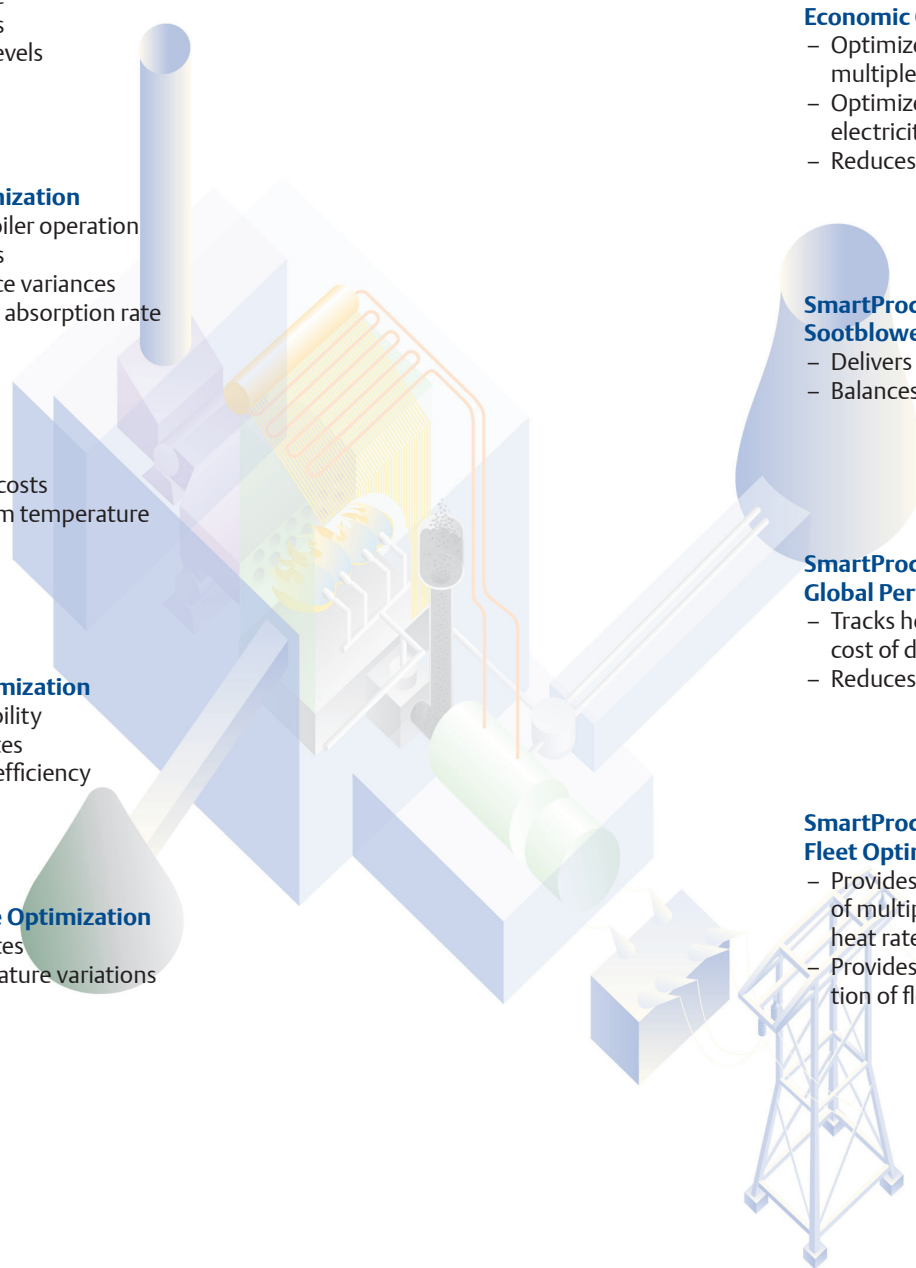
- Delivers optimal cleanliness
- Balances blowing sequences

SmartProcess Global Performance Advisor

- Tracks heat rate deviations and cost of deviations
- Reduces operating costs

SmartProcess Fleet Optimization

- Provides regional optimization of multiple units for emissions, heat rate, and revenue
- Provides browser-based visualization of fleet performance

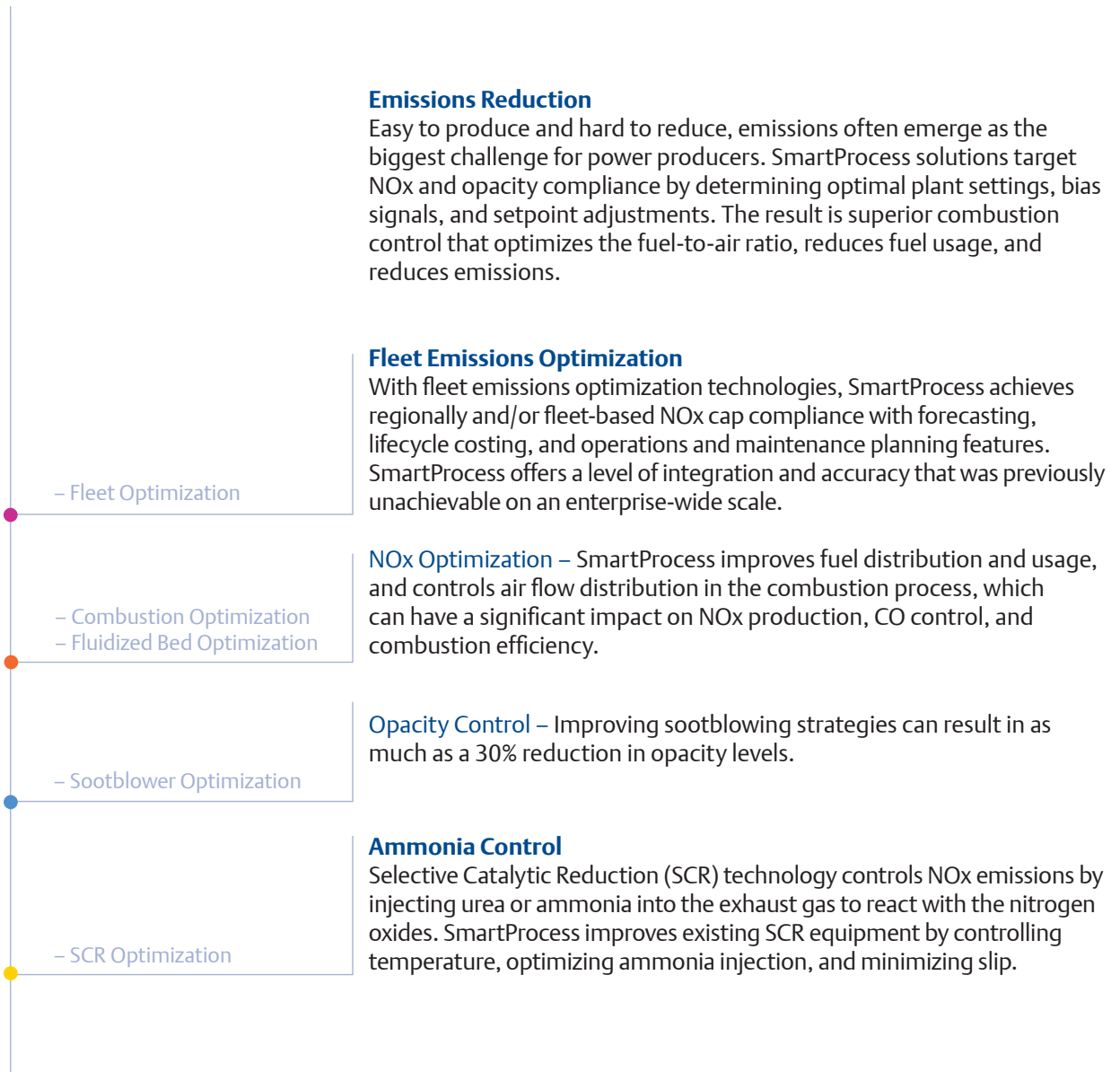




Environmental Management

Emerson is committed to improving the environmental performance of our customers' power plant operations. Our plant optimization solutions target key performance goals, like significantly reducing emissions while maintaining efficiency.

SMARTPROCESS™ OPTIMIZATION TECHNOLOGY



Unit Performance



High-performing individual units make continuous improvement of an entire generating operation possible. Whether working as a series of units within a single power plant, or a single generating station within an entire fleet, if one unit is under-producing or producing inefficiently, the risk of losing incremental revenue can be mitigated.

SMARTPROCESS™ OPTIMIZATION TECHNOLOGY

- Combustion Optimization
- Fluidized Bed Optimization
- SCR Optimization
- Unit Response Optimization
- Economic Optimization
- Steam Temperature Optimization
- Sootblower Optimization
- Global Performance Advisor

SmartProcess plant optimization technology can work with the operating parameters of a single unit to offer overall performance improvements. SmartProcess minimizes forced outages by reducing stress on boiler tubes and turbines. It improves load flexibility through increased ramp rates, reduced startups, and minimum loads. It even maximizes heat rate for improved boiler efficiency, reduced slagging, and reduced fuel costs. As a unit's efficiency improves, a corresponding improvement in the entire power plant or fleet is the natural response.

Boiler Optimization

Even an improvement of 1% can result in cost savings of more than \$500,000 for a 500-megawatt, fossil-fired unit. SmartProcess increases boiler efficiency while maintaining emissions, decreasing loss on ignition, and reducing a number of other plant operating costs.

Dispatch Optimization

Whether implementing the electricity and/or steam dispatching at any given moment or for a period of time, SmartProcess can help plants improve unit heat rate and ability to swing loads, and react to changes in fuel costs, electricity and steam demands, and equipment efficiency.

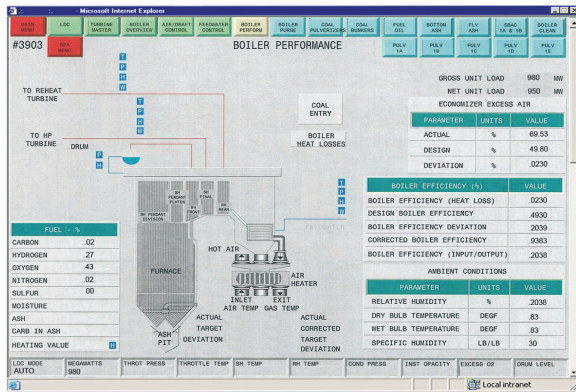
Equipment Performance Improvement

Each unit has unique characteristics and optimization needs. Emerson offers SmartProcess solutions to target the exact problem areas in your plant. Plants can target the precipitator to reduce opacity or the SCR to improve ammonia usage. SmartProcess even offers boiler-type-specific optimization solutions for your cyclone boiler, fluidized bed boiler, or component solutions such as model-based mill control.

Real-time Performance Benchmarking

SmartProcess reduces operating costs by tracking unit heat rate penalty costs over time. It indicates dollars lost due to equipment performance deviations from design and provides customers with critical performance data to increase overall plant efficiency.

Designed for your unique

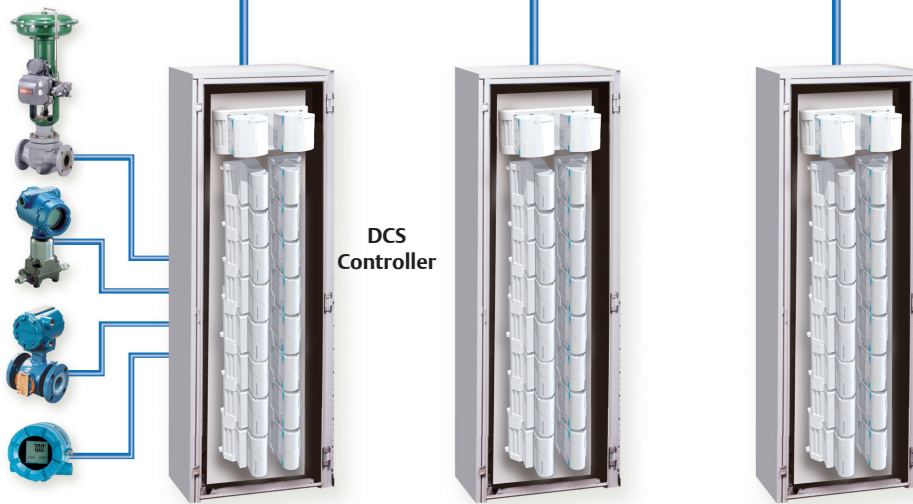


SmartProcess Global Performance Advisor

Operator Workstation

SmartProcess Combustion Optimization

Engineer Workstation



Typical SmartProcess Integration

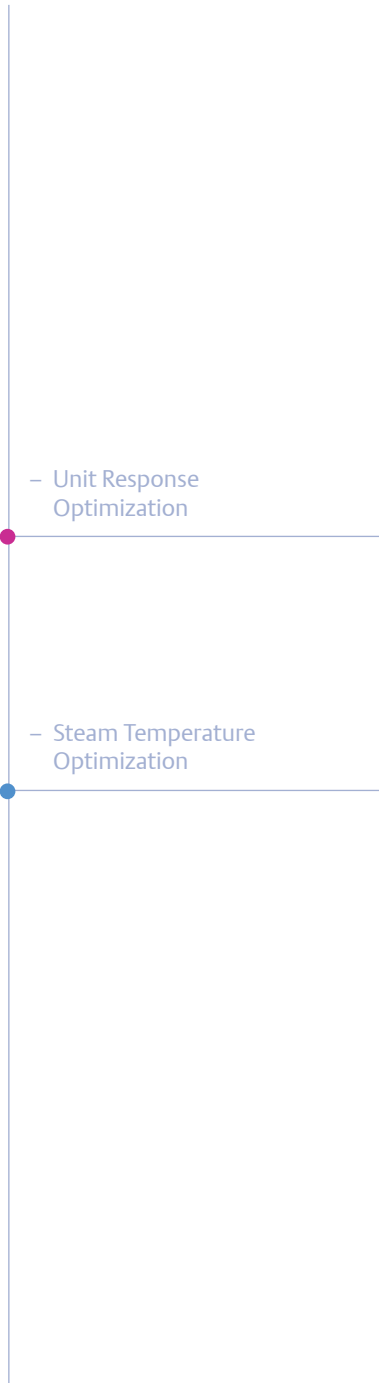
needs and applications

Operational Flexibility



Emerson Process Management's customized optimization technology enables customers to recognize and respond to changing plant conditions. SmartProcess solutions offer plant enhancements and optimization to improve performance and flexibility.

SMARTPROCESS™ OPTIMIZATION TECHNOLOGY



- Unit Response Optimization

- Steam Temperature Optimization

SmartProcess solutions help to better manage power production capabilities. Through optimizing ramp rate, startup conditions, market capabilities, ancillary services, and application performance, SmartProcess solutions improve the consistency of operations, fluidity of response, and overall evolution of distributed control technology, so power plants can operate at their fullest potential.

Unit Flexibility Optimization

Unit stability and responsiveness are critical to a power plant's operation and its ability to capture market revenue opportunities. SmartProcess technology increases plant ramp rates by modeling and optimizing boiler and turbine responsiveness. With optimized unit stability, generating units will be able to run in a stable manner at low load levels and avoid throttling losses. With SmartProcess, utilities can also significantly decrease startup time, increase unit stability during startup, improve AGC capabilities, and realize ramp rate improvements of 1-4%/minute.

Steam Path Optimization

Temperature variations and high steam pressure can be devastating to boiler and turbine components. SmartProcess optimizes steam temperature control to achieve faster ramp rates, improved turbine life, and reduced stress on boiler pressure parts. With SmartProcess, utilities see a reduction in maintenance needs, outage requirements, and turbine steam path fatigue.



Fleet Management

Now, more than ever before, balancing generation performance with profitable business practices is demanded, not just suggested. To succeed, utilities need a better way to exchange real-time data among corporate offices, regional plants, and individual operating units.

SMARTPROCESS™ OPTIMIZATION TECHNOLOGY

– Fleet Optimization

SmartProcess solutions use fleet optimization to address new pressures, like the need to make quick decisions using accurate data, manage workforce and workflow efficiently, and centralize disparate data at one convenient location.

Fleet Emissions Optimization

With fleet emissions optimization technologies, SmartProcess achieves forecasting, lifecycle costing, and operations and maintenance planning with a level of integration and accuracy that wasn't previously achievable. SmartProcess allows power producers to see how their actions in one area will impact the organization's other assets and operating profits. By managing their assets fleetwide, power producers can balance conflicting responsibilities, such as controlling air emissions and environmental compliance targets, with corporate financial responsibility over the entire range of units, plants, and offices, no matter how far apart each facility may be.

– Global Performance Advisor

Fleetwide Performance Visualization

SmartProcess offers all-in-one, browser-based, fleetwide performance visualization for alarms, reports, calculations, optimization, advanced analysis, and plant performance metrics. By gathering data from the entire fleet or plant to one centralized location, SmartProcess provides a flexible, unified source of data for analysis, calculations, and process optimization. Using an enterprise data system, you can access and display data in the form of graphics, trends, and reports. It also contains a set of tools that allow the user to create reports and calculations.

– Economic Optimization

Enterprise-wide Economic Optimization

SmartProcess offers economic optimization for real-time, online applications throughout the enterprise. Using integrated tools, users can configure applications for a range of tasks, including data recognition, performance monitoring, open- and closed-loop real-time optimization, and multi-time-period coordinated optimization. SmartProcess formulates optimization strategies to enable robust integration with plant control schemes and allowances for process dynamics.

SmartProcess technology means our customers are even stronger competitors in the power market. Whatever your control system, each SmartProcess solution delivers concrete measurable improvements long after its installation. Better efficiency, dramatic cost savings, and increased profits means each SmartProcess solution pays for itself.



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