Process optimization and energy management for fertilizer production

The demand for fertilizer and the appropriate production plants is rising. TIA and TIP ensure safety, efficiency, and quality.

Processes in the fertilizer industry are extraordinarily complex. Continuously high safety standards must be maintained to prevent danger to personnel, the environment, and all assets. At the same time, the process and product quality have risen significantly in recent years.

Fertilizer production also requires large volumes of fossil fuels; around 1.4 percent of global energy consumption is accounted for by the production of ammonia, for example. Optimal operation and the efficient use of energy determine the cost-effectiveness and CO₂ emissions of these plants. With TIA (Totally Integrated Automation) and TIP (Totally Integrated Power), Siemens offers the right tools for safe and efficient operation of fertilizer plants.

Expensive downtimes are reduced in this way, and the foundation of an intelligent energy and maintenance management system is laid. These are all measures for boosting the performance of the plants as well as minimizing operating costs over the entire plant life cycle. Siemens has been a reliable partner to the fertilizer industry for years.
which in turn benefits from the company’s expertise and global services.

At Petrokemija, the largest regional manufacturer of mineral fertilizer in Kutina, Croatia, they have modernized all their safety systems, including the emergency shutdown system (ESD) and alarm system. The centerpiece of the installation comprised the SIMATIC PCS 7 process control system and the SIMATIC ET 200M I/O system for connecting the fail-safe and non-Ex signals. The system has a redundant design and thus achieves maximum availability. The company profits from reduced installation and wiring costs and faster commissioning. Operators and engineers on-site are trained down to the last detail so that later, if the plant situation demands it, they can also make independent changes to the configuration and the visualization system.

In Tedjen, Turkmenistan, a state fertilizer complex supplies primarily the rising cotton industry in Asia. Siemens provided the process automation system and accompanied the project from delivery, through installation, to commissioning. This involved the engineering, combining hardware and software, assembling the control cabinets, the system test, and delivery of all the automation systems. Not only the control system, but also the measurement technique must be tailored precisely to each situation. The Swedish company Yara deals with highly corrosive nitric acid and thus requires correspondingly rugged and reliable flowmeters. Slight inaccuracies will result in incorrect accounting and cash losses further down the line. The solution is the SITRANS F C Mass 2100 Coriolis flowmeter, which records the relevant fractions as well as the mass flow.

Motors, drives and pumps use large volumes of electrical power in the fertilizer production. Energy-efficient devices must be used to reduce power costs. The “smart” Motor Control Center (MCC) offers further potential. Thanks to the integration of data from the motor control into the SIMATIC PCS 7 process control system, operators have all the information available that they require for analyzing and optimizing energy use.

The flexible and modular SIMOCODE pro motor management system for motors in the low-voltage range prevents faults in a plant and thus costly downtimes. The trick: It can be connected simply and directly to the automation system via PROFIBUS DP ensuring optimal motor capacity utilization.

SIMATIC PCS 7 provides libraries for SIMOCODE pro, which handle all motor protection and control functions. Operating data, diagnostics data, and statistical data, enable both intelligent motor management and future-oriented energy management.

With “Drive” to more savings

Motors with frequency converters enable significant energy-savings over the life cycle. As component parts of TIA and TIP, all Siemens drive systems are easily integrated into the automation system.
The right lever for energy efficiency

Reliable measuring instruments, closed-loop control concepts, and software tools.

Correct measurement of energy, whether that is in the form of gas, steam or electricity, is crucial to optimized energy consumption. Only when consumption values and power data are available in a precise form over an extended period can meaningful comparisons be made and selective measures taken to increase efficiency. As well as flowmeters and the SENTRON PAC for acquiring and displaying all consumption quantities, there are further tools for optimizing energy consumption. The software SIMATIC powerrate collects, calculates and records all energy data for selective optimization of energy consumption. The energy management system b.data optimizes workflows by automating all the processes relevant to the supply of energy.

In addition, the Advanced Process Control (APC) function integrated into the SIMATIC PCS 7 process control system also contributes to the optimization of energy consumption. By using this effective closed-loop control concept, undesired fluctuations in critical process variables can be drastically reduced, perceptible cuts can be made in the consumption of raw materials and energy, and throughput and product quality can be increased.

Detailed knowledge of the process

Process gas chromatographs and gas analyzers provide higher product quality, process quality and efficiency.

Ammonia production involves a host of process stages – from desulfurization and the primary reformer, to the synthesis reactor. Sudden deviations within the stages would influence all subsequent process steps with consequences for product quality and also process quality and efficiency. The quality of the natural gas already influences the consequent process, since it provides the nitrogen required for ammonia production. SITRANS CV supplies all the necessary information on natural gas quality as well as the gas-specific properties such as calorific value and density.

For environmental protection reasons, gas emissions, such as those from the primary reformer or sliving gases from the synthesis stage, must also be monitored with maximum accuracy. Here too, Siemens offers intelligent solutions. The product range of Siemens Process Analytics encompasses continuous gas analyzers (extractive and in-situ), process gas chromatographs, and systems for sampling and analyzing. To ensure the analysis system working reliably for years, it is precisely adapted to local conditions and is available in a host of versions, for cabinet installation or field installation, for example, or with explosion protection or corrosion proofing. A flexible networking concept allows connection to control systems the maintenance stations via PROFIBUS, OPC, Modbus, or Industrial Ethernet.

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The big picture
Siemens integrates automation into a life cycle concept.

Demand for fertilizer is undiminished. According to information from the IFA (International Fertilizer Industry Association), 65 new production sites for nitrogen-based fertilizer will be established by 2014. At the same time, many fertilizer plants have been in operation for years and require upgrading to the latest state of the art. Only integrated automation, embedded in a life cycle concept, will do justice to both situations. Plant managers can secure investments in the long term and maximize return on assets. Regular downtimes can also be used for modernization purposes, to improve energy efficiency or boost throughput.

Fertilizer processes are also challenging because they require beside the synthesis many subprocesses and ancillary processes, such as transport of materials, and packaging. Here too, Siemens is the right partner: with compressors, weighing systems, or MES concepts.

Whether gas processing, packaging, energy management, or the efficient use of raw materials, a “greenfield” plant or an old factory within a larger network – in all cases, plant managers benefit from an integrated and universal system.

TIA and TIP can be adapted to present and future plant sizes, both with regard to quantity structure and functionality.

Existing fertilizer plants, many dating from the 1950s, can be made fit for international competition thanks to intelligent maintenance and migration strategies.

Existing plants can be easily expanded or modernized. When all the components interact optimally with each other, this results in safe processes, optimized use of raw materials, and high cost-effectiveness.

Info:
www.siemens.com/tia
www.siemens.com/tip

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Do you have questions regarding our offerings for process optimization and energy management of fertilizer production?
Would you like more information on our products, systems, solutions, and services? Write to us – we look forward to hearing from you:

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