EcoStruxure™
Innovation At Every Level

Schneider Electric APC for Mining, Minerals, and Metals

Industry solution

Case study on thickener

In today's environment, Mining, Minerals and Metals companies are faced with volatile market swings and soaring energy costs. To meet these challenges, mining operators are forced to optimize and make performance improvements that will positively affect their bottom line.

EcoStruxure Advanced Process Control for Mining, Minerals, and Metals (MMM) from Schneider Electric allows the operation to function much closer to the operating limits by reducing variations in the process. The hybrid rule-based and model-based predictive control (MPC) package can often reduce variability by a standard deviation of two or greater and, as a consequence, improves profitability by enabling operations within process constraints.

Benefits

- Optimize thickener performance by maintaining consistent underflow density and bed level.
- Maximize water recovery while minimizing flocculant and reagent consumption.
- Improve operational continuity and prevent feed-related process interruptions.
- Reduce variability and stabilize key process parameters across shifts and operators.
- Operate closer to process constraints with multivariable predictive control.
- Achieve ROI in less than 6 months with measurable improvements in throughput, quality, and energy efficiency.

Challenges

- Improve product density stability and maximize throughput capacity
- Minimize reagent consumption
- Improve integration with upstream units
- Improve water recovery

Solution

EcoStruxure Advanced Process Control for Mining, Minerals, and Metals.

Results

- ROI less than 6 months
- Over 1% water recovery increase
- Product consistently on density target
- Consumables savings

What is a thickener?

Thickening or dewatering may be defined as the removal of a portion of the liquid from a slime made up of a mixture of finely divided solids and liquids.

Thickening takes place after concentration processes such as grinding-flotation. The process involves regular discharge of the thick dense material as it settles at the bottom of a tank or tank farms. Reagents called flocculant are added to improve the settlement of ultrafine and fine particles. Rakes revolve at a speed sufficient to move the material as fast as it settles without enough agitation to interfere with the settlement.

Typically, in dewatering processes, the objective is to recover process water, which is then treated and recirculated back into the processing plant.
Consequently, a product with a targeted density or percentage of solids is obtained. This simple concept is critical for efficient and safe downstream operations such as smelting and/or tailing dams.

Figure 1

Thickener system within the mining site

Typical Case Study

Challenges

Here are some of the common challenges in implementing EcoStruxure Advanced Process Control.

Cultural

- Lack of understanding of process control technologies (e.g. PID vs Fuzzy Logic vs MPC)
- Resistance to new control technologies—this can be overcome by training and simulations
- Previous unsuccessful trials or implementations preventing future opportunities despite benefits.

Technical

- Limited manipulated variables
- Non-linear relationship between process variables
- Varying ore characteristics
- Unpredictable feed rates
- Multiple line configurations
- Density and water clarity assays with long delays are commonly the primary controlled variables
- Frequent feed interruptions and full or partial process shutdowns and many units operating in semi-continuous mode
- Unmeasured upstream disturbances such as water addition, mineral changes and recirculation.

Solution objective

- Improve water recovery
- Improve product quality stability (density or percentage of solids)
- Maximize feed rate subject to quality constraints
- Maximise % solids in the mud
- Keep rake's torque and pump amps within limits
- Improve operational continuity
- Maintain water quality (clarity) within range
- Minimise flocculant addition

Benefit analysis

The benefits of implementing EcoStruxure Advanced Process Control could come traditionally from:

- Stabilizing product density
- Maximizing through EcoStruxure APC for MMM in
- Reducing energy and consumables consumption
- Keeping safe and reliable operational conditions

This is typically calculated by running a series of on/ off tests and comparing the unit performance when the EcoStruxure APC application is on and running with reasonable constraints versus operation under DCS/ manual control.

Typical benefits range from 1% to 5% flocculant reduction and water recovery increase which results in a payback period of less than 6 months.

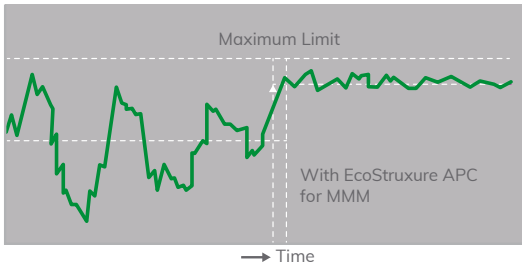

Figure 2

Effects of EcoStruxure APC

Our technology

EcoStruxure APC for MMM is a hybrid rule-based expert system and model predictive control (MPC) that connects directly to a wide variety of automation systems and uses both real-time and historical data to analyze, identify, and model the significant cause-and-effect relationships in a process. Identification and verification of cause and effect relationships are powerful analytical tools that provide an engineer with valuable insight into process behaviour and understanding of process characteristics.

The solution simultaneously controls a number of process parameters that maintain the product within specification. Taking into account process dynamics, interactions, constraints, and economics, EcoStruxure APC for MMM predicts future process behaviour and takes control and optimization actions before product measurements are out of specification, reducing process variability and allowing the system to work closer to its limits.

Classic variables

Manipulated variables

- Mud bottom flow rate
- Flocculant flow rate

Control variables

- Bed pressure
- Mud density
- Rake arm torque
- Bed level
- Water turbidity

Feed forward variables (measured disturbances)

- Feed flow
- Feed density

20+

hybrid control variables enabling predictive, real-time optimization across complex process dynamics and constraints.

Why EcoStruxure APC for MMM for thickener?

Particular process characteristics make EcoStruxure APC for MMM a valuable solution:

- Multivariable interactions with long dead times such as cause-effect relationship between feed rate/rake arm torque/bed level/ underflow density
- Multiple constraints on variables: maximum bed level and rake arm torque
- Inconsistencies in product qualities: underflow density results between shift and/ or operators
- PID loops in manual such as flocculant additions and density controllers
- Manual assay information used to update process control performance
- Process control has to target multiple objectives such as consistent underflow density, safe and reliability operation of rake and pumps, flocculant reduction, throughput increases, energy savings, and water makeup improvements
- EcoStruxure APC for MMM is a hybrid application
- Operational efficiency: is a key factor driving productivity and safety
- Processes not performing to specification

How does EcoStruxure APC for MMM solve these problems?

- Predict future process operational point based on training and learning from past performance
- Upstream disturbances are modeled and predicted before affecting the process
- Multiple input/output and awareness of downstream process constraints
- EcoStruxure APC finds optimal trade-offs when conflicts among the goals exist
- Hybrid rules based and MPC logic that allows integrating discrete variables such as laboratory samples and assays
- Enables the process to be driven closer to active constraints

Benefits of EcoStruxure APC for MMM

For many process units, a single control technology cannot deliver a profitable and stable optimization application. The process units are simply too difficult to control and exhibit characteristics that cannot be handled by a single technology. A hybrid application uses the strengths of each technology to achieve peak operating performance.

Improvements in technology offer an opportunity to improve the profitability of many MMM plants. New approaches in optimization systems expand the range of potential applications and offer potentially tremendous benefits with a short ROI. The combination of a flexible and capable toolset, application expertise, and the power of continuous improvement is now providing continuous and significant performance benefits to the industry.

Improve your economic performance

- Is your plant operating at its highest production rate potential, or market demand?
- Can optimized control improve the product yield and/or energy efficiency of your plant?
- Can optimized control improve the uptime for your plant?
- Can optimized control on a unit generate operating benefits in downstream units?
- Do feed stock costs, energy costs, or product prices vary?
- Do you experience divers operations performances across shifts?

30%+

performance gains through hybrid optimization technology for maximum profitability and rapid ROI.

Backed by a world-class solution portfolio

The success of EcoStruxure APC for MMM is a combination of:

- Ongoing cooperation and partnership between Schneider Electric and you
- Extensive experience in the Mining, Minerals, and Metals industry
- Flexibility to design custom solutions for each customer's needs
- A flexible and superior optimization tool set, combining hybrid rule-based and MPC technology in one single platform
- Numerous years of optimization expertise
- Commitment to continuous performance improvement for each customer

For more information about Schneider Electric EcoStruxure APC for Mining, Minerals and Metals, please contact your local SE representative or visit: https://www.se.com/ww/en/

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