



Proficy CSense

Global References & Case Studies

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Uniquely providing five analytics capabilities in one package, Proficy CSense has helped organizations around the world reduce costs by turning raw data into rapid business value. Engineers and data scientists can analyze, monitor, predict, simulate, and optimize and control set points in real time through Proficy CSense.



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Proficy fast-tracks process improvement in the Rolling Plant



Chrome Ore Processor

Chrome Ore Processor Optimizes its Complex Production Process with Operations Optimization, powered by Proficy CSense



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Based in Denmark, Herning Vand strives to efficiently deliver clean water to its customers



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Lonmin increases smelter throughput by 10% while improving recovery



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Implements electronic quality checks and corrective actions



Rockwool

Proficy CSense's Troubleshooter advances Rockwool's capacity for process analysis

"We use Proficy's advanced analytics as a kind of process intelligence (PI), so we have benefited from all the data we collect. We have done an energy project where we reduced stirring in the process tanks by 35%-45%. It is not necessarily the energy we have saved (as the price is low), but the reduced operation we have and thereby less wear and maintenance. The next project is CO2 reduction in aeration tanks, where we will try to optimize O2 in relation to nitrous oxide emissions."

— Ulrik Folkmann, Operations Manager, Hedensted Spildevand

Outcomes



Reduce process variability

Combine data and use analytics and machine learning to improve process variability



Speed troubleshooting

Use data to troubleshoot causes of asset and process performance issues rapidly



Increase engineering productivity

Proficy CSense's visual analytics accelerate problem detection and improve efficiency



Decrease downtime

Monitor and ensure health and performance of base-layer PID control loops



Optimize with a Process Twin

Mine new insight from industrial data to maximize return on assets



Improve data integrity

Validate and clean raw sensor data at the source to ensure integrity of downstream systems

ArcelorMittal South Africa boosts its yield by getting the kink out of its coil

Proficy fast-tracks process improvement in the Rolling Plant



ArcelorMittal South Africa produces steel for niche markets with specific quality requirements. The plant has an annual output of about 1.2 Mt.

The company has embarked on a Six Sigma continuous improvement drive that included, among things, the implementation of Proficy software from GE Digital.

The application helps eliminate production problems by analyzing plant data in real time and determining the probable causes at the Iron making plant. At ArcelorMittal South Africa, one of the problems was cobbling. The Rolling Plant receives 20 ton steel slabs from the Thin Slab Caster.

These go through four stages of rolling:

- Firstly, thickness is reduced from 82 mm to 20 mm by two roughing mill stands.
- The sheets are then coiled in a coil box.
- After uncoiling, the material goes through a five-stand finishing mill to reach a final thickness of between 1 mm and 4mm.
- In the final stage the sheets are coiled in a down coiler.

Cobbling can occur at any stage of the Hot Strip Mill, when the steel jams rather than passing smoothly between the rolls – similar to a paper jam in a printer. The cost of a cobble is significant, as both the affected coils and the upstream slabs at the caster (the kick-off slabs) are usually scrapped. In some cases the cobbled coils can be used after being reworked.

At ArcelorMittal South Africa, 0.4 percent of all coils produced were cobbled. The elimination of cobbling would therefore increase the yield of the plant, as well as its productivity and revenue.

“Since commencement of production we’ve made this product with consistently high quality and corresponding customer satisfaction.”

— **André Theart**
Six Sigma Black Belt

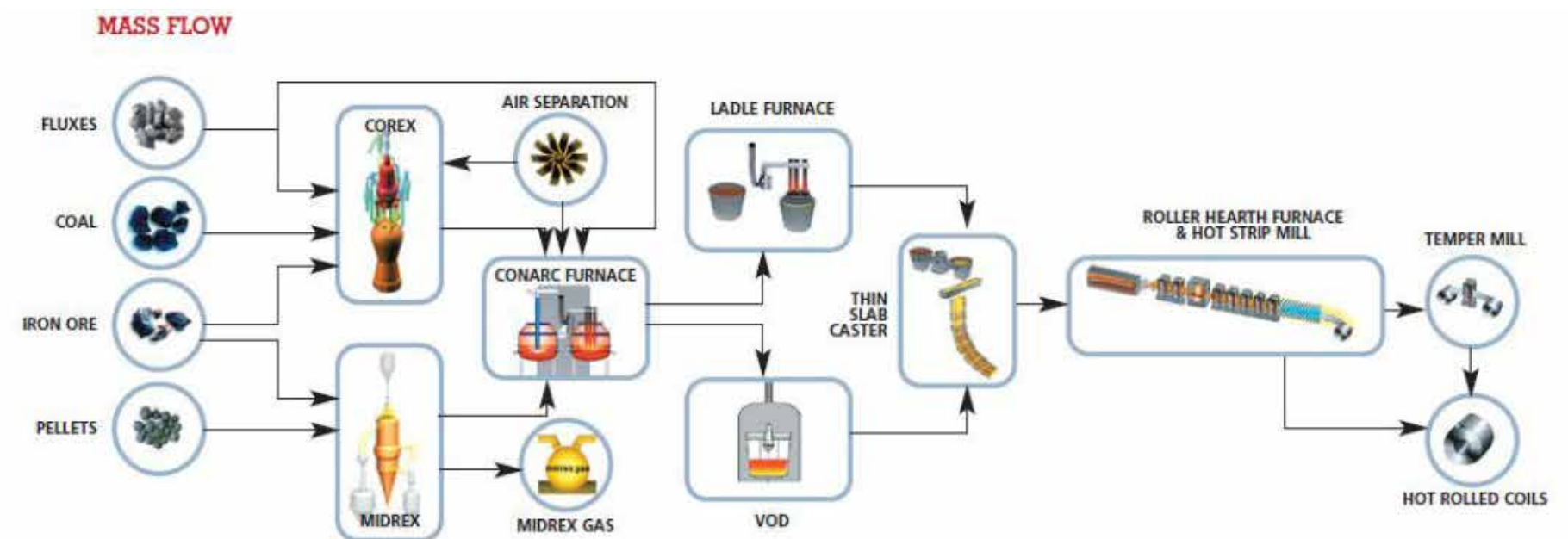


Figure 1: Steel-making Process

By using Proficy CSense, including the Troubleshooter module it was possible, within 30 minutes, to identify the major causes of cobbling at the down coiler:

- A principle component analysis (PCA) fingerprint was created by using the process data relating to cobble-free coils. Three clear operating clusters were observed representing, respectively, the start, middle and end of a rolling instance.
- Next, the process data relating to a specific
- Cobble instance was loaded. With a click of a button the major contributor to cobbling was identified: the pressure transducer on the side guide.
- By replacing the pressure transducer, the root cause for the cobble at the down coiler was eliminated.

André Theart, one of ArcelorMittal South Africa’s Six Sigma black belts in training, says that with Proficy, the plant’s project cycle times were significantly reduced, process set-points intelligently established and implemented, and knowledge of the overall process greatly enhanced. The result was a significant improvement in business value.

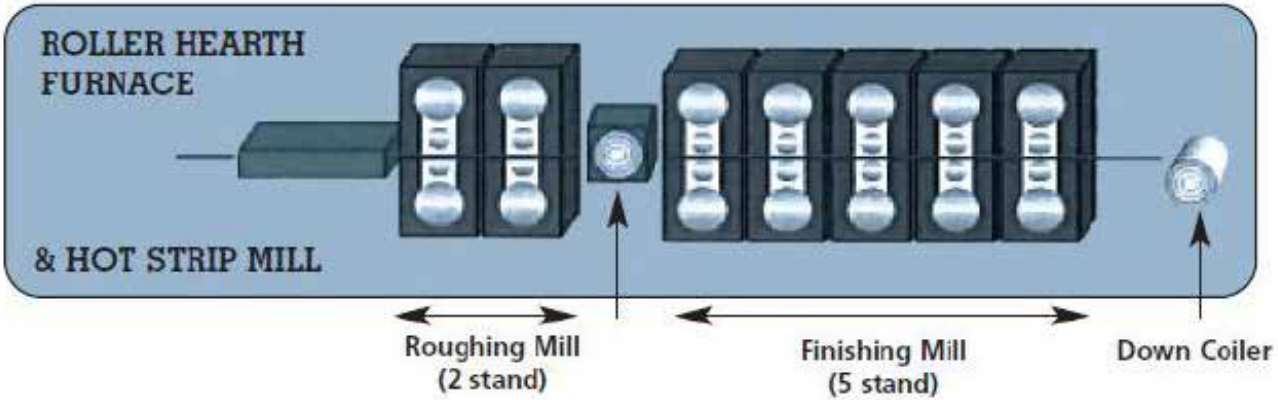


Figure 2:
Steel Rolling Process

Launching a new product with confidence

Proficy not only enabled ArcelorMittal South Africa to improve the production of its existing products, but also helped it launch a new product. The company had identified an opportunity to supply the market with high quality steel for cut-sheet applications having a flatness measurement of less than 56 I-units. André Theart employed Proficy CSense's Troubleshooter to establish the process conditions under which this specialist product could be rolled. He extracted this set of rules from historical production data making use of, among others, Proficy’s intelligent decision tree. This methodology, facilitated by Proficy, gave the manufacturer

the confidence to implement the set-points recommended by the software prior to the first rolling campaign. “Since commencement of production, we’ve made this product with consistently high quality and corresponding customer satisfaction,” says Theart. “Over this short period we’ve succeeded in rolling more than 20 000 tons of steel in line with the strict flatness specifications and supplied it to our various customers – a first for the plant.” As a result of its contribution to process and productivity improvements, Theart plans to continue using Proficy for Six Sigma projects at ArcelorMittal South Africa – “and we hope to get even more astonishing results in the future!”

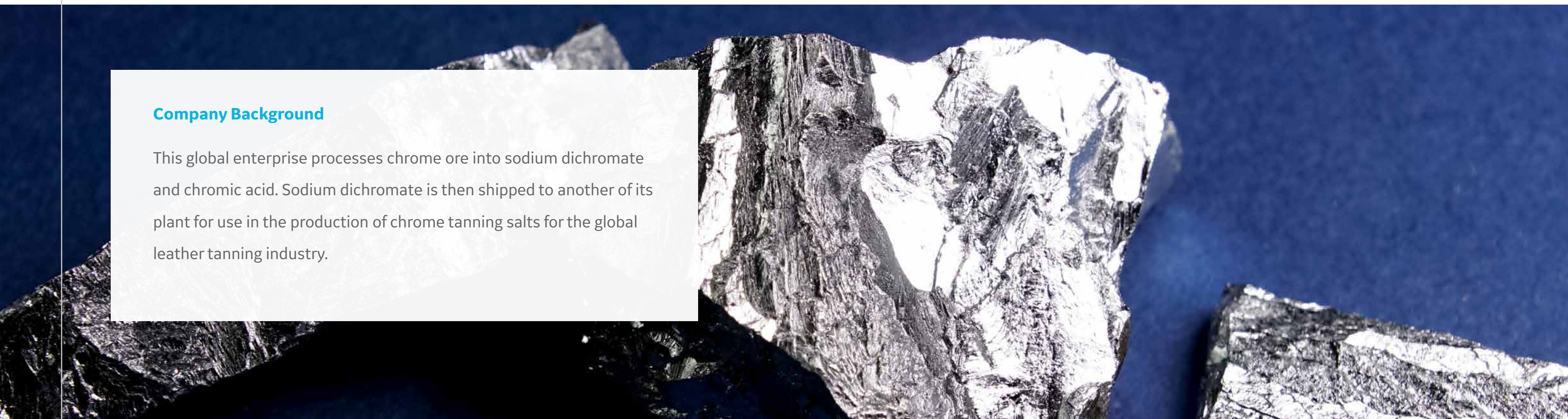
“Now that we’ve proved that Proficy can effectively and rapidly find the cause of cobbles, our next step should include its application to finding the root causes of cobbles in the Finishing Mill, the Roughing Mill and the Coil Box.”

— **André Theart**
Six Sigma Black Belt

Chrome Ore Processor Optimizes its Complex Production Process with Operations Optimization, powered by Proficy CSense

Company Background

This global enterprise processes chrome ore into sodium dichromate and chromic acid. Sodium dichromate is then shipped to another of its plant for use in the production of chrome tanning salts for the global leather tanning industry.



Challenges

With complex production processes, this chrome ore processor needed to ensure optimal control of its operations to meet quality, energy and throughput targets. Potential areas for optimization that were identified were base layer (PID) control as well as implementing Advanced Process Control (APC) on complex unit operations.

Process challenges included the need for better pH control, greater stability, and an opportunity to maximize throughput on the crystallizers. There were many manual processes that were heavily paper-based in an overall reactive environment.

Control loop management was a key area, where automation staff did not have enough visibility into loop problems to be proactive. They were reliant on the operators and production staff to surmise when operation parameters moved outside control limits and to let the automation team know if they thought it was controller-related.

It was also difficult and time consuming to get to root causes of control deviations. Issues with loops could include tuning, control-element sizing, plant design (such as process conditions changing faster than the controller could handle), manual operator issues, and large disturbances in the process.

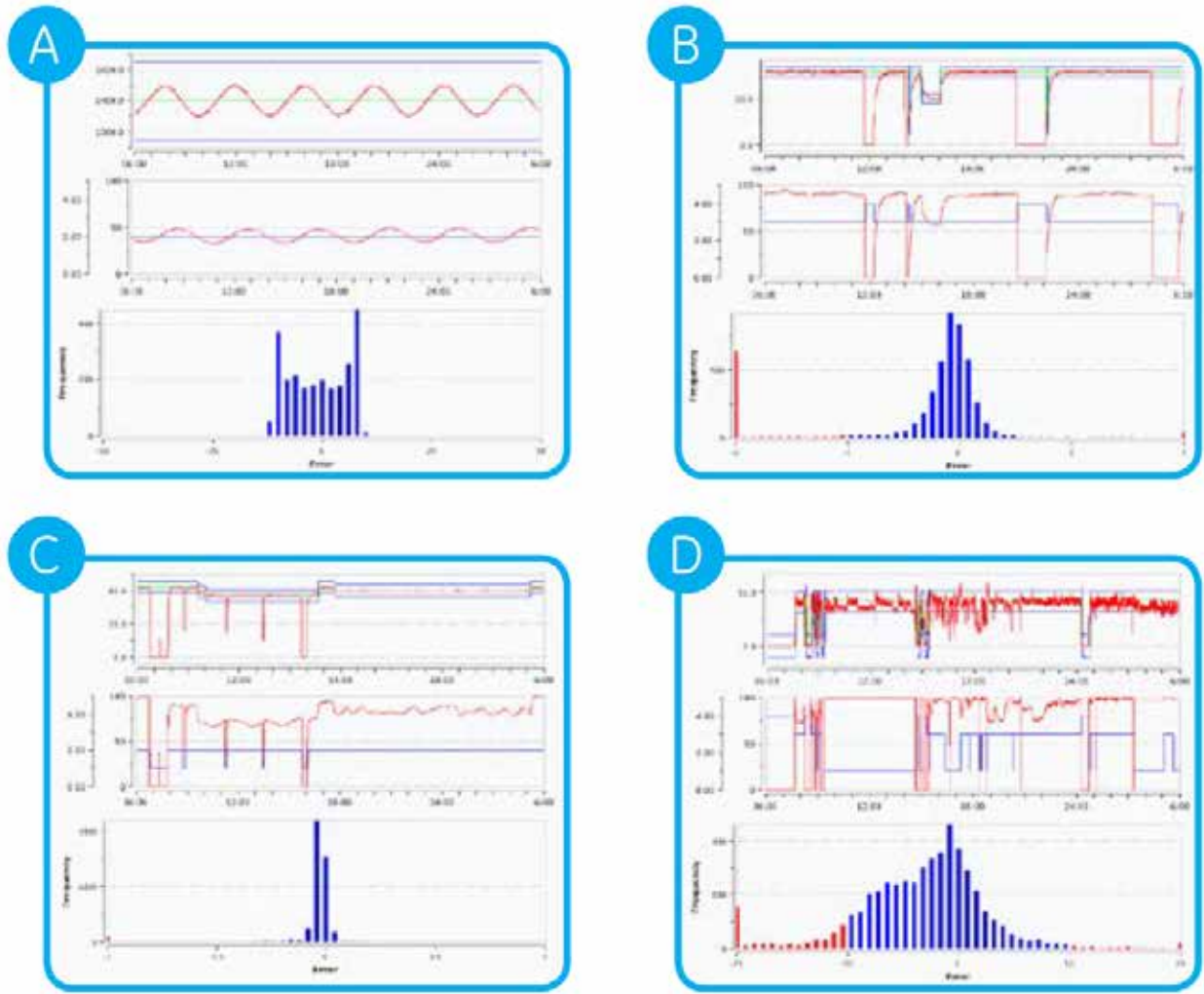
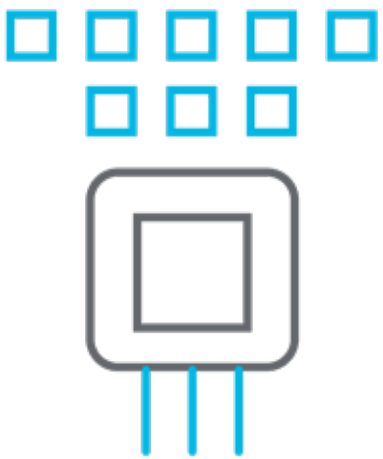


Figure 1:

Examples of control loop problems - Tuning (A), Plant (B), Operator (C) and Process (D).



Not only was it difficult to control operations within set parameter; it was challenging to optimize operations, keeping values as close to the control limits as possible.

The interdependency of variables made goals such as energy optimization and process optimization challenging.

The company sought a solution that would form part of a continuous improvement cycle so that the control system would never be static but would rather contribute towards incremental process improvements. It wanted an innovative way to help run its operations smarter, faster and better with less manual interaction—optimizing its production and profitability for utmost competitiveness.

The GE Solution

The global enterprise turned to GE Digital's Proficy CSense — an analytics and optimization software solution that could provide the company with the Advanced Process Control and PID loop performance monitoring capabilities it was looking for in order to provide visibility into developing process issues and push productivity to new levels.

The solution provides insight into process and control problems and allows staff to identify what has changed and why, leading to better decision making. It also closes the loop through its APC solutions, controlling multi-variable processes.

Control Loop Management supports continuous improvement

When a control loop is inefficient, the Proficy CSense solution enables rapid and effective responsiveness. The solution provides daily summaries and reports so staff can quickly identify an issue and investigate changes to minimize deviations outside set parameters.

In addition, the Proficy CSense solution helps:

- Maintenance engineers identify design problems
 - Chemical engineers identify production and design problems
 - Improve energy savings because of the accurate measurement and control of gas, steam and electricity
 - Drive higher quality in the final product
 - Maintain environmental controls within specification
 - Improve production throughput
-



“GE’s solution allowed us to tune all our control loops to an acceptable level and empowers process personnel to identify plant problems on a daily basis.”

— Operations Manager
Chrome Ore Processor

Advanced Process Control leads to increased throughput and quality

Before implementation of Proficy CSense, most programmers of controllers in a process unit and process operators were not able to focus on the plant's goals of optimizing quality and maximizing profitability. Instead, they were absorbed in the vertical application of their expertise.

With the new solution, Advanced Process Control enables all the controllers on a process unit to work together to achieve the larger process objective. It can trigger improvements before products are out of specification, which allows for a proactive approach.

There is also more information available, as the solution enables on-line mass, component and energy balances. It's also possible to monitor the conditions of a process using state-based functions, and cyclic processes can now be modeled based on the state of the cycle. In addition, manipulated variables can now be controlled based on all of this information, which was previously not possible.

The crystallization units at the plant were the perfect candidates for Advanced Process Control. Multiple feed streams and varying moisture and sodium content made these processes difficult to operate optimally with reactive control strategies. Sodium content of the product often was outside of the allowed specification limits, leading to wasteful rework of the product.

The Operations Manager explains, "Since implementing Proficy CSense, sodium content has consistently been within specification, leading to minimal rework. Using GE's solution, we've increased capacity by 30–40%."

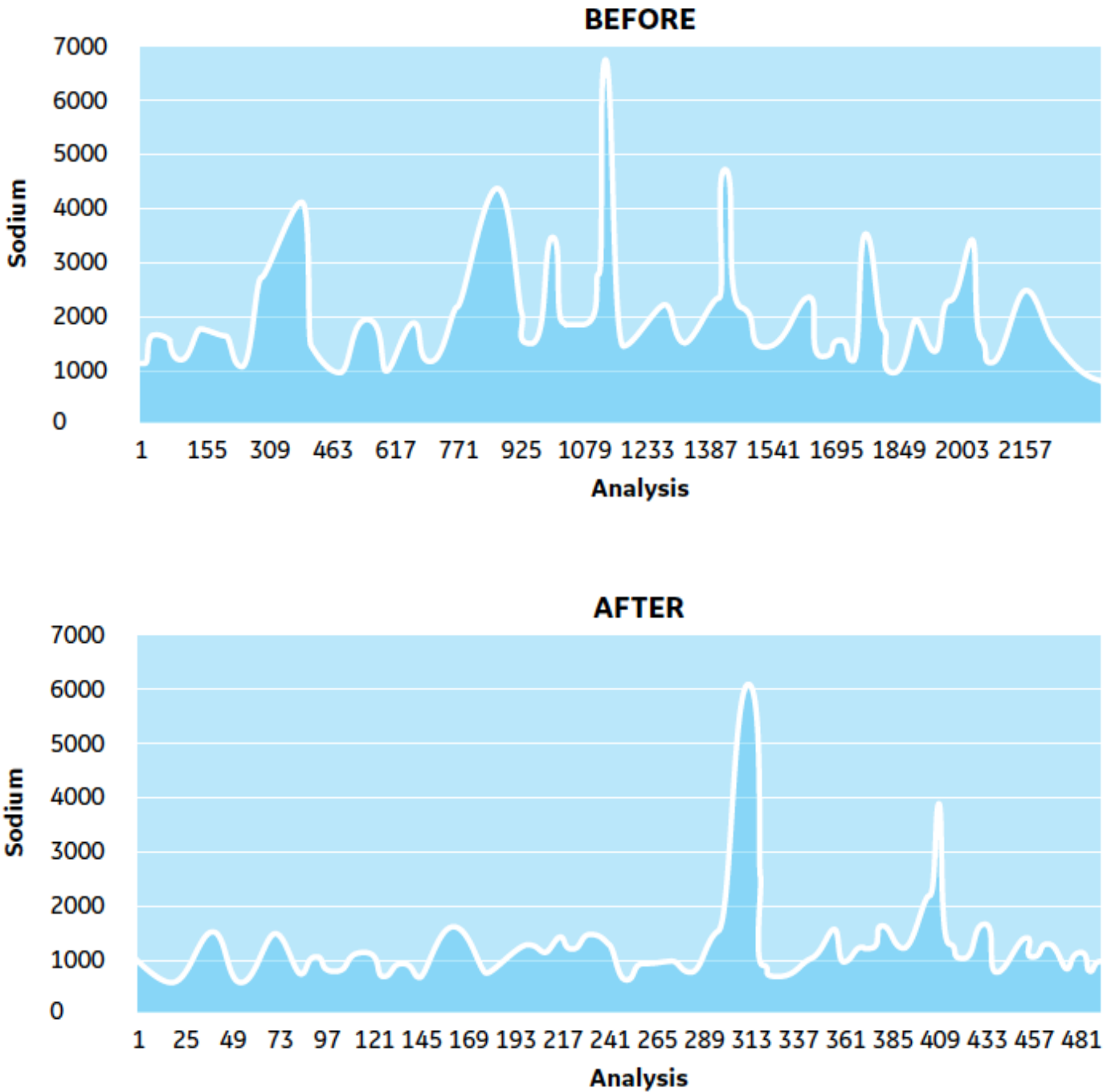


Figure 2:

Sodium left on crystals after crystallization before and after the implementation of Advanced Control (target 1000 ppm). This resulted in much less product rework due to sodium content, and the plant availability increased significantly.

“I recommend GE's solution, as without it, we would see a lower overall standard of control as well as various control problems. We're now able to leverage innovation to optimize our operations and stay competitive.”

— **Operations Manager**
Chrome Ore Processor

Results



30–40% increased
operational capacity



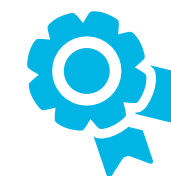
Optimized processes
and plant availability



Better, faster
responsiveness to issues



Increased product quality
and reduced rework



Improved energy
efficiency

The benefits of GE's digital solution have led the company to meet its objectives of process optimization and profitability. The solution helps the company make timely and informed decisions, and it minimizes process variability for improved, sustainable production performance.

Looking ahead, the company plans to train its engineers to uncover additional opportunities in other areas of its plant to leverage Advanced Process Control and monitoring for a competitive edge.

Exxaro and Wabtec Bump Up Throughput at Coal Operation



10%

Increase in throughput

+98%

Utilization since commissioning

6 month budgeted cycle

Successful POC

Introduction

About Exxaro

Since their formation in 2006, Exxaro Resources Limited has grown to become one of the largest and foremost black-empowered coal and heavy mineral companies in South Africa, with other business interests around the world in Europe, the United States of America, and Australia. Our asset portfolio includes coal operations and investments in iron ore, pigment manufacturing, renewable energy (wind), and residual base metals. In 2019, Exxaro produced 45.6 million tonnes (Mt), reflecting contributions from our expanded flagship Grootegeluk mine. At 31 December 2019, the group had assets of R68.8 billion and a market capitalization of R47 billion (US\$3.3 billion).



[Watch Video](#)

Challenge: *Like many industries, coal processing is complex, and digital transformation provides an opportunity for improvement. The absence of advanced process controllers (APCs) in the coal processing industry led Exxaro to explore research into opportunities for improvement, particularly in the area of throughput.*

Action

With research showing that Exxaro could expect a 5% gain in throughput, the company worked with Wabtec to implement Advanced Process Control, leveraging GE Digital's Proficy CSense and process digital twin technology, at its GG45 process plant. Following success, the team implemented two more APC projects and explored a skills transfer process to Exxaro engineers to maximize use of the solution.



Outcomes

- Nearly 10% gain in throughput
- Utilization higher than 98% (from commissioning to date)
- Proof of concept completed within 6-month budgeted cycle
- APC solution is now solely utilized to control the GG5 plant, including start-up, shutdown, and steady state conditions
- Continued collaboration and continuous improvement

About the Speakers

Hennie Engelbrecht, Principal Engineering – Process Improvement & Performance, Metallurgy, Exxaro Resources

Hennie Engelbrecht is the Principal Engineering for Process Improvement & Performance, Metallurgy for Exxaro Resources. With nearly 20 years in mining and metallurgy including managing the operations of the largest coal beneficiation complex in the world, he has extensive experience with process and performance improvement. Prior to his current role, Hennie served as the metallurgy manager, coal beneficiation manager, and chief engineer of process development. He holds a Bachelor of Engineering (Chemical Engineering & Extractive Metallurgy) from Stellenbosch University.

Marnus Olivier, Lead Project Manager and Advanced Process Control/Data Science Engineer, Wabtec

Marnus Olivier is a Lead Project Manager and Advanced Process Control/Data Science Engineer for Wabtec. In this role, Marnus develops and implements advanced process control solutions for global mining companies – with outcomes ranging from stabilizing pH and temperature to optimizing throughput and reducing waste. His expertise in applying advanced process control, predictive models and analytics spans 10 years at a diverse set of mines. Marnus holds a MScEng in Chemical Engineering from University of Stellenbosch along with certifications in data science in machine learning.



Herning Vand gathers valuable knowledge with their historical data

Based in Denmark, Herning Vand strives to efficiently deliver clean water to its customers

Going Beyond Big Data

"Big Data" has become a buzzword and everyone agrees that it is worthwhile to explore the large volumes of data. Herning Vand has invested in an advanced calculator that can help to interpret their process data and already in the first project they came across particularly valuable knowledge.

“We have achieved some excellent results with our first project and we see a great future optimization potential with the tool.”

—Jan Ravn, Chief Operating Officer at Herning Vand

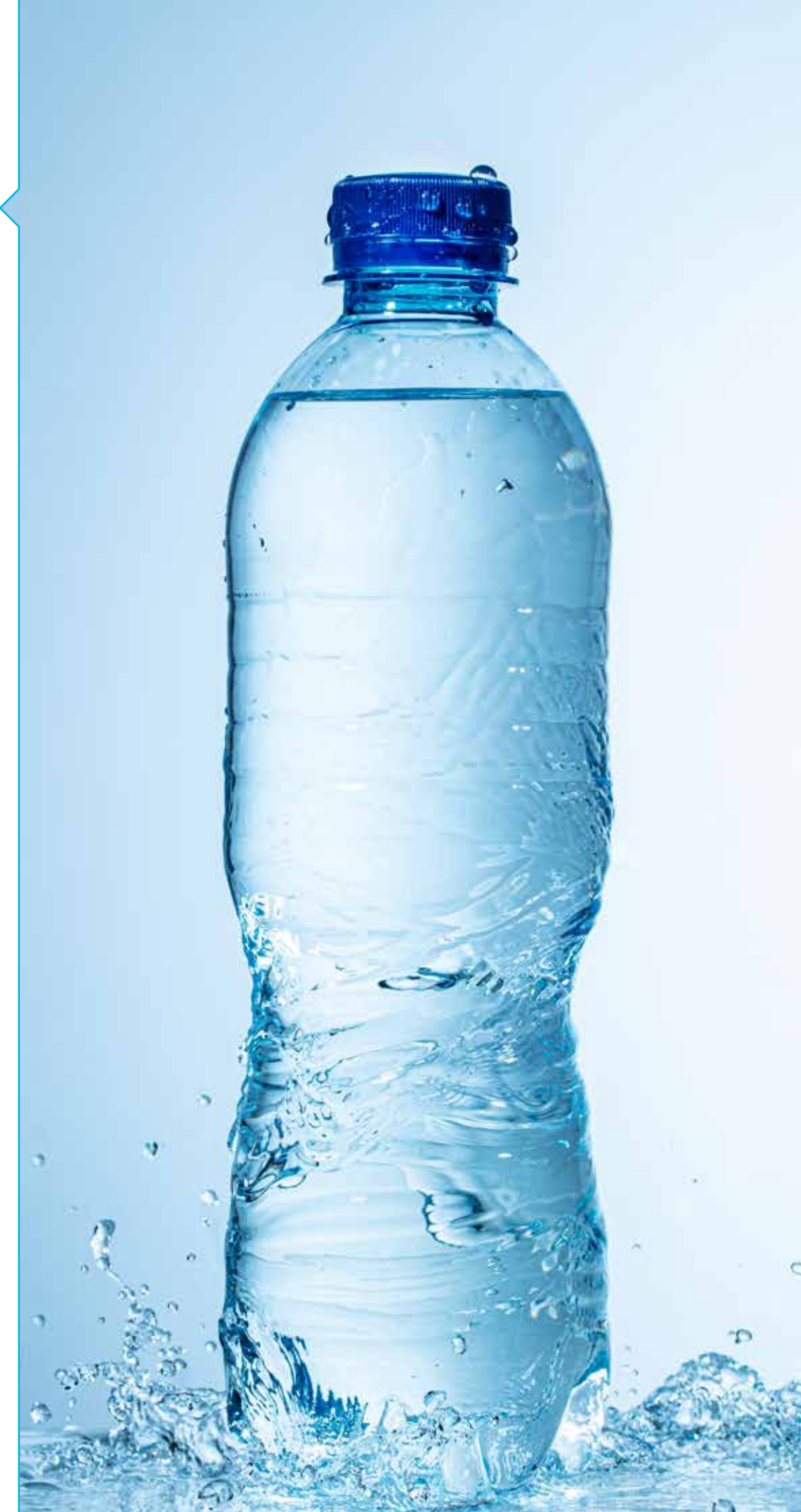


For years, Herning Vand has recorded and saved a large amount of process data that is collected online from Herning Vand’s 14 purification plants.

The data is logged with the clear intention to make Herning Vand wiser and therefore better equipped to optimize processes and the overall operations. However, for that to happen the large volumes of data must first be sorted, analyzed, processed, evaluated and thoroughly compared so that the important correlations and trends can be localized.

However, Proficy CSense shall, just like other simulation tools, be used shrewdly and Herning Vand, together with process consultants from COWI who were responsible for the initial consultancy, gained some valuable experience. COWI assists Novotek, a GE Digital partner, with process technical advice in connection with the use of Proficy CSense.

“A spreadsheet can be used to handle relatively large amounts of data, but it will not work when there are too many parameters in play simultaneously. Therefore, last spring we invested in Proficy CSense software solution, which is dedicated to finding and using mathematical correlations of large amounts of data,” — Jan Ravn



Is there a connection?

"I see Proficy CSense as a closed box that is filled to the brim with advanced calculation routines. We just feed the box with the data we want it to compute and then we tell it what parameters we want to observe.

Proficy CSense finds the right mathematical description of the data stream and can then show two curves of the same data stream. One curve contains the actual data and illustrates the process as it was in reality. The other curve is generated by the mathematical model that Proficy CSense has set and therefore shows a simulated process.

When the program is fed with multiple data streams at once, it automatically locates the possible relationship that exist between the different data and that is exactly what we are after."

— **John Sorensen, Senior Project Manager for water and wastewater at COWI.**



When CSense has found the mathematical models and correlations, the user can then determine which parameters to focus on and what to look out for. Just like when you insert different values into an equation. Here it is just an automated solution to an almost unlimited number of equations.

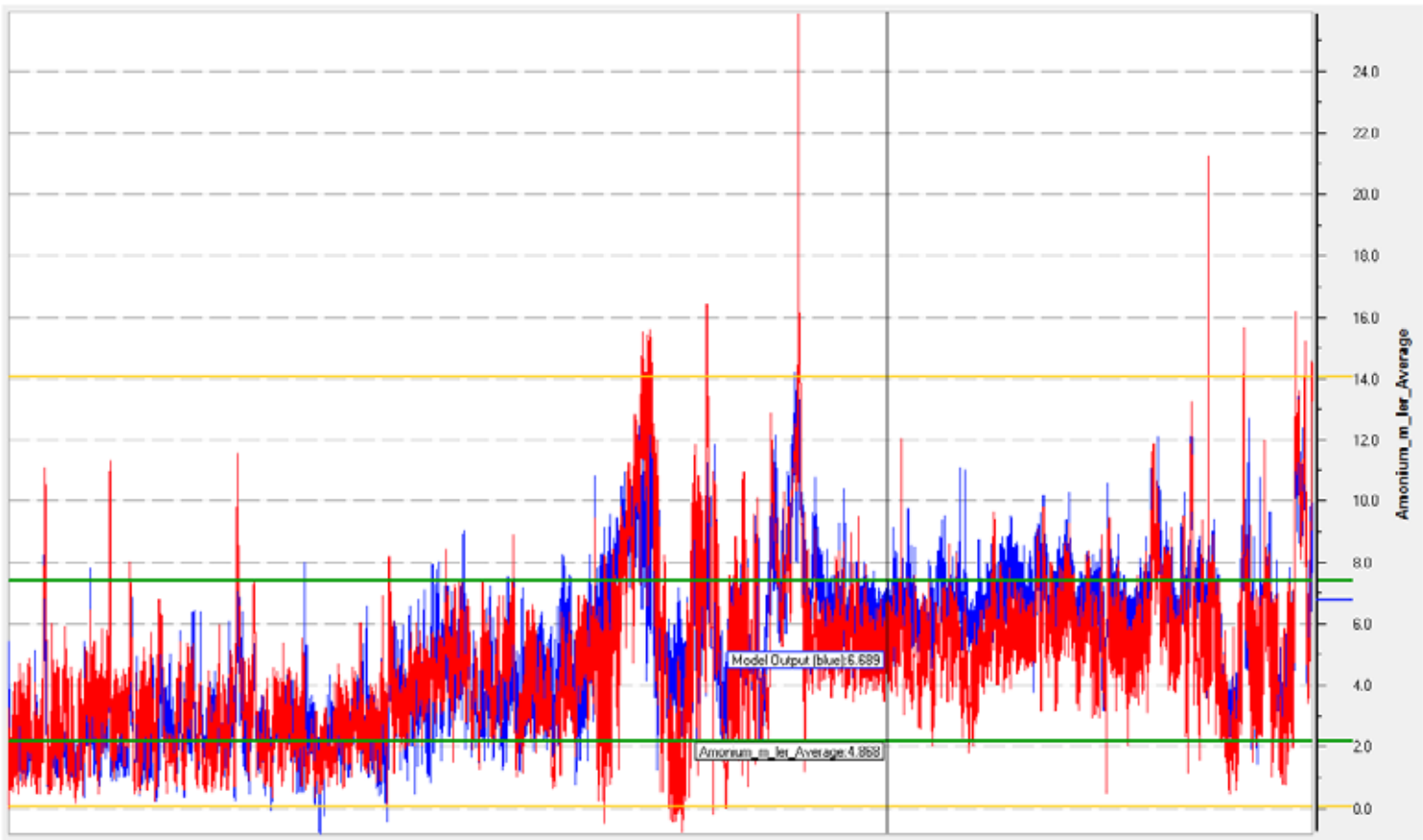


Figure 1: Modeling of variations in ammonium concentration. Proficy CSense has generated a model where the result is shown by the blue line. The red line is the measured values.

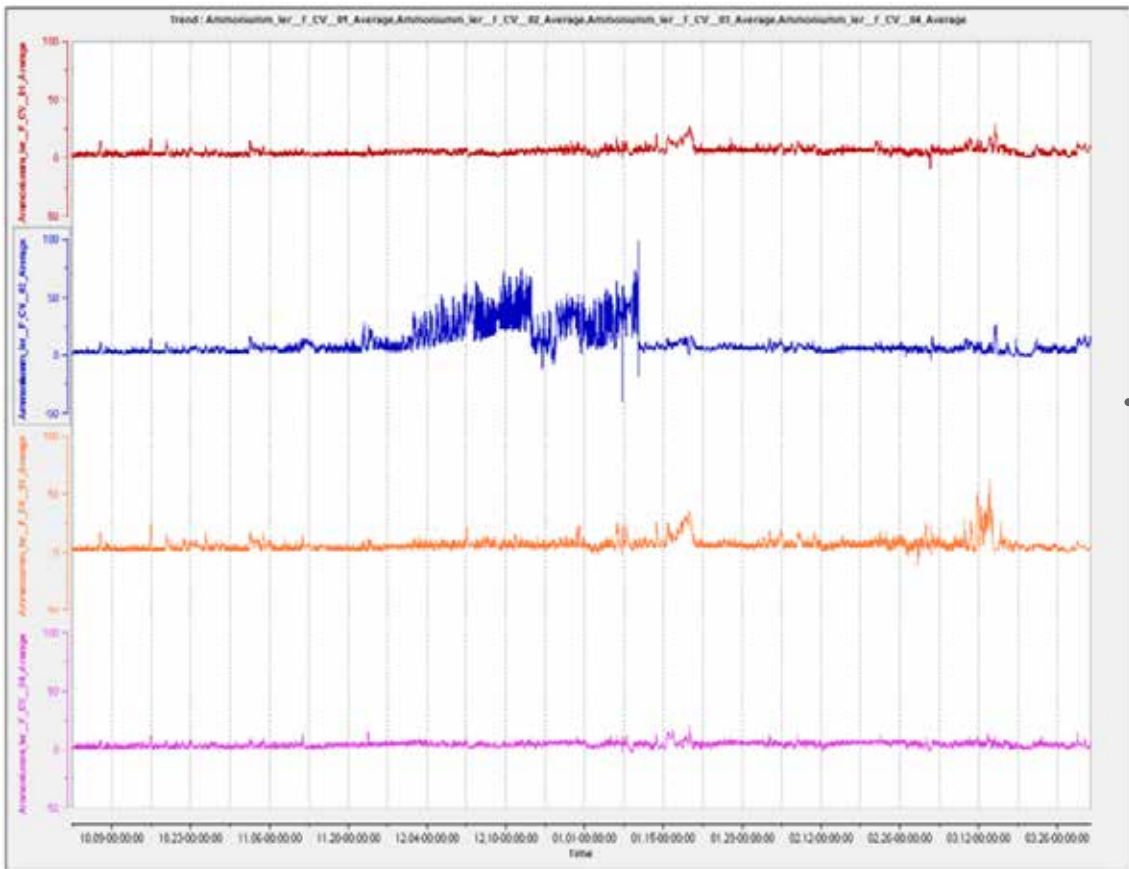
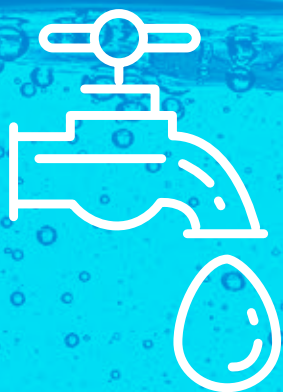


Figure 2: Simple comparison of trend curves to get a quick overview of the situation. The figure shows the ammonium concentration in four process lines.



"We can find correlations that we did not know existed and our theories can be confirmed or dismissed. Once we have located the significant correlations, we can begin to optimize the process based on this new knowledge,"

"If, for example, I want to have output A as high as possible, how should I then set inputs B, C and D?"

—Jan Ravn

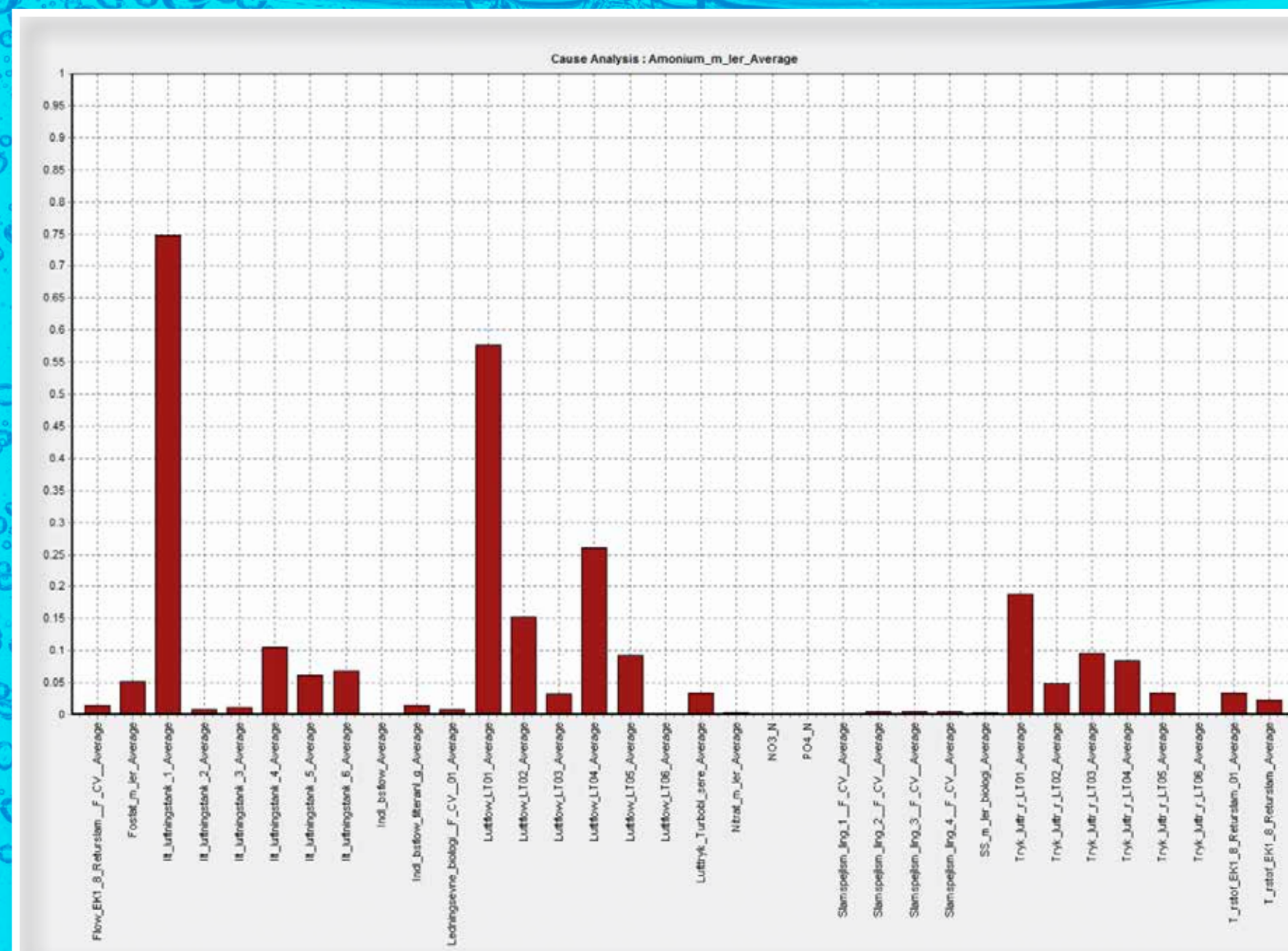


Figure 3: Proficy CSense has identified the parameters that have the greatest influence on a given run-off result.

A savings of DKK 500,000

The first project, which was the optimization of the gas production that is based on sludge from the purification plants, gave an output improvement of as much as 20%.

The gas is used for electricity production and according to Jan Ravn the increase corresponds to an annual additional production of approximately 400,000 kilowatt hours, which earns Herning Vand approximately DKK 500,000.

Herning Vand is now engaged specifically in a series of small defined projects that will ultimately achieve the goal of making Herning Vand energy neutral.

“We knew roughly which buttons we had to press to achieve this gain and so CSense should not take all the glory. However, the tool makes it much easier for us to check the accuracy of our assumptions and it can also show us the way to the process-related correlations that we cannot find ourselves.

— Jan Ravn

The Art of Definition

The advice from Jan Ravn and John Sorensen is that you have to be good at defining the amount of different data that CSense works with and you get the best and fastest results if you have relatively robust process knowledge.

The more data you put in means you get more answers out at the other end. However, there is of course an upper limit,

and too many parameters in play can make it difficult to understand the results.

As Jan Ravn explained, "Our advice to new users is that you start simple and carefully consider both what it is you want to have answers to and also what parameters are likely to affect these answers. If you do not know exactly which parameters affect your focus area, you can gradually reduce the number using Proficy CSense as you test each one. When the data streams are recorded and analyzed they fit together mathematically, so when you adjust each parameter up and down with the mouse, you see how the other parameters are affected to either go up, down or remain unchanged. When you have isolated the relevant parameters there is the option to activate the tool to simulate towards an optimum process within a given framework."



Jan Ravn and John Sorensen
assess the collected information.



The first project is only the tip of the iceberg in relation to what we expect to achieve with Proficy CSense. We have an ambition that the tool will be used regularly for small and large projects, and therefore assist us to pick all the low-hanging fruit that would otherwise be missed during a busy working day,”

The findings are instantaneous and the application potential is great.”

— Jan Ravn

Impala Platinum reduces process variation by 40% with Proficy CSense

Background

Impala Platinum's Base Metals Refinery (BMR) in Springs, South Africa, receives its raw material from the company's mining, concentrating, smelting, and converting facilities in nearby Rustenburg.

The BMR then removes as much of the base metals as possible and sends the Platinum Group Metals (PGM) concentrate to the Precious Metals Refinery (PMR) plant for further processing. The base metals are refined and sold separately to maximize the conversion of raw material into revenue.



The Challenges

Poor pH control, complex, multi-variable environment

Impala Platinum identified difficulties in controlling the pH in the first stage autoclaves, and poor pH control has a serious and negative impact on the PMR processes. It had to decrease the base metals content (thereby increasing the precious metal content in the concentrate), which could be done by controlling the pH and consequently improving the nickel and iron extraction efficiencies.

Up to this point, the pH had been controlled through a cumbersome process of manual sampling and operator intervention. Responses to changes were delayed and future values could not be predicted automatically.

As shown in Figure 1, the first stage leaching process involved operators having to deal with numerous interdependent variables (pH, temperature, levels, pressures, etc.).

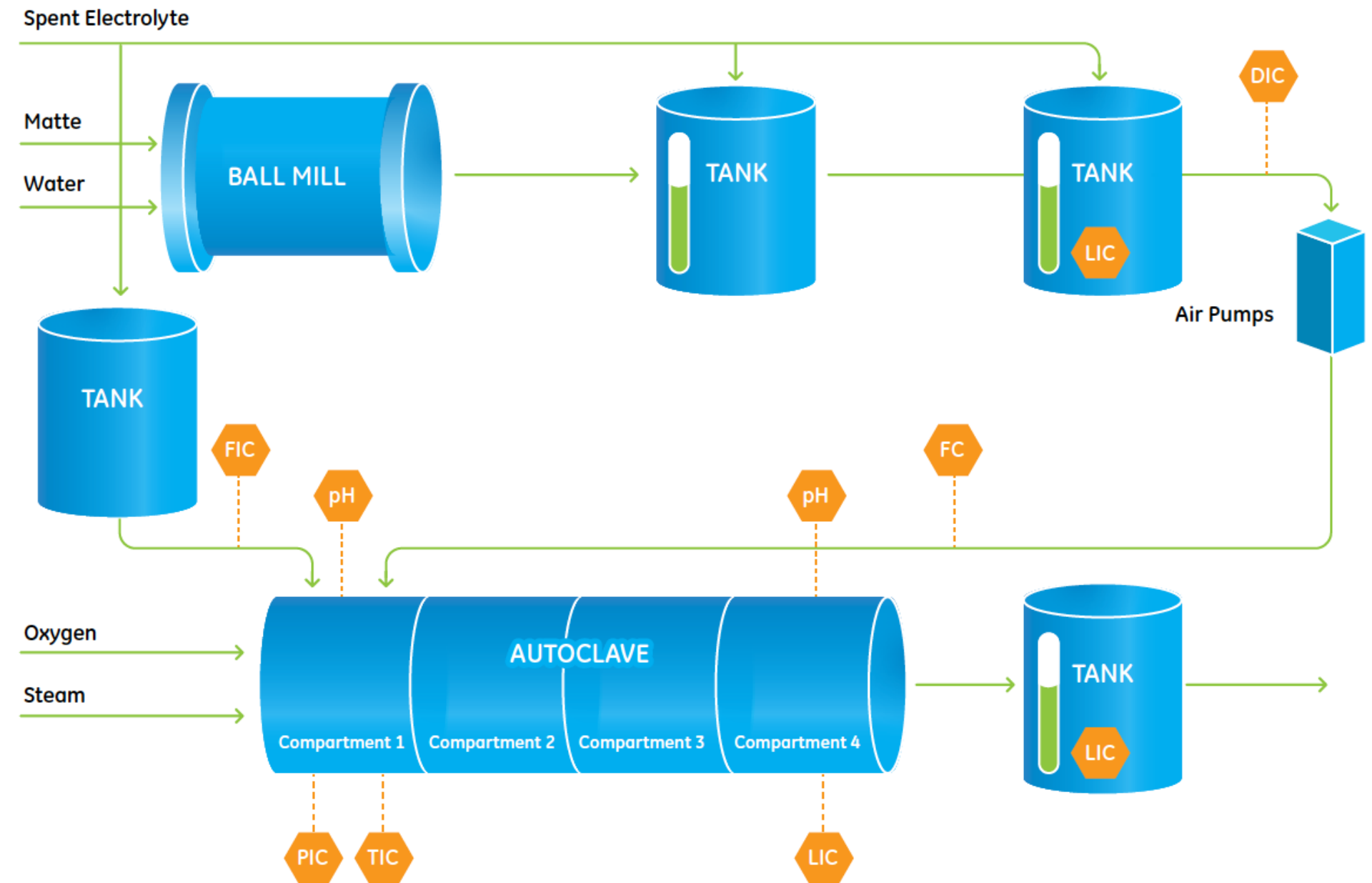


Figure 1:

An overview of the process

The processing of platinum is a complex and costly affair. The quality of the upstream process known as Base Metal Refining (BMR) can have serious financial consequences on the profitability of the downstream Precious Metals Refining (PMR) process.

With operators having to juggle all these variables, it was easy for temperature and pH profiles, for example, to go beyond their set limits. This affected Impala's ability to remove as much as possible of the nickel from the solids, and it degraded the quality of all products downstream.

Another important metal to remove (leach) in this process was iron, which had to be kept in solution. To do that, active pH control needed to be applied to the autoclave. Iron should be discarded with the nickel solution otherwise it would contaminate the PGM solids, which would impact downstream processes negatively and can even lead to costly reworking of the concentrate.

In addition, ore grade is gradually dropping and there are large variations in concentrations in the matte supplied by the smelter. All of this contributes to an environment where manual process optimization is extremely challenging.



BASE METALS REFINERY
(dissolution of nickel, copper and cobalt)

The Solution

Advanced pH controller provides real-time optimization

Impala Platinum turned to GE to help address its challenges. Over a period of six weeks, GE installed its Proficy CSense solution, providing Impala BMR with control and optimization of its nickel-leaching process. The software relieved operators of many decisions that were previously difficult given the complex, variable, and real-time nature of the processes in their charge.

An advanced controller based on a hybrid of analytics technology and fundamental principles was implemented to provide:

- *Stabilization of the pH to improve the leaching efficiency of iron and nickel. This provides a better quality of PGM concentrate for PMR and other processes.*
 - *On-line and real-time pH sampling. This provides the degree of control required to help optimize the process. Another consideration was that pH cannot be measured inside the autoclave, so a special sampling pot was designed by GE to address this sampling problem.*
 - *Simplification of the control approach by manipulating acid addition to compensate for pulp density and product feed rate changes, as well as changes in pH measurements, while taking into account that high-pressure acid leach has complex reaction dynamics.*
-



“Some systems are just too complex and have too many variables for operators to run optimally. That’s when we need the help of predictive solutions that can deal with the complexities of our unique problems.”

— Tim Spandiel,
Impala BMR Manager



“Although these numbers may seem small, they are extremely significant to the financial benefit of all our refining processes.”

— Tim Spandiel,
Impala BMR Manager

GE's Proficy CSense solution helps to increase process efficiency

Since the solution was implemented, it has greatly reduced the level of impurities in the product from the BMR, thus increasing the concentration of PGMs. This ultimately leads to more platinum being extracted in the PMR downstream.

Sello Semosa, Impala's BMR Manager, said that operators have embraced the solution, which has led to increased productivity. She explained, “With Proficy CSense, I know I have a dedicated solution that is running real time with no disruptions. It has freed up time for me and my staff, and time is important in terms of production.” Enabling effective information sharing across the company, the solution automatically provides performance reports. This enables management to have a near real-time view of the efficiency of the BMR nickel leaching process on which so many other processes rely.

Solution results:

40%
improvement

in pH stability whereby
variation was reduced
from 1.2 to 0.7

0.5%
increase

in nickel extraction
efficiency

3.3%
increase

in iron extraction
efficiency

1.4%
increase

increase in the PGM
grade (concentration)

Other benefits included:

- Reduction in pH peaks in the autoclave, which can lead to certain elements becoming very difficult to leach. These elements go right through the process and end up contaminating the PGM solids, with the result that the entire batch has to be recycled through a lengthy and costly processing pipeline.
- Acceptance of the system by operating staff
- Stable process control in spite of variations
- Indirectly limits environmental emissions

Lonmin increases smelter throughput by 10% while improving recovery



When platinum prices were at an all-time high, Lonmin wanted to maximize efficiency and unlock any hidden capacity in its process. GE previously helped the Lonmin concentrating section to solve some tough challenges, so GE was called in again to help with a bottleneck in the smelter area. This would prove to be the start of a new partnership in which GE would help Lonmin with its continuous-improvement journey through optimization and operational transparency.

Lonmin is the third-largest producer of PGM (Platinum Group Metals) in the world. The company's operations are located in the Bushveld Complex near Rustenberg in South Africa.



↑ 10%

Increase in throughput in the filter and drying section

↓ 25%

Decrease in variation in feed into the slag mill

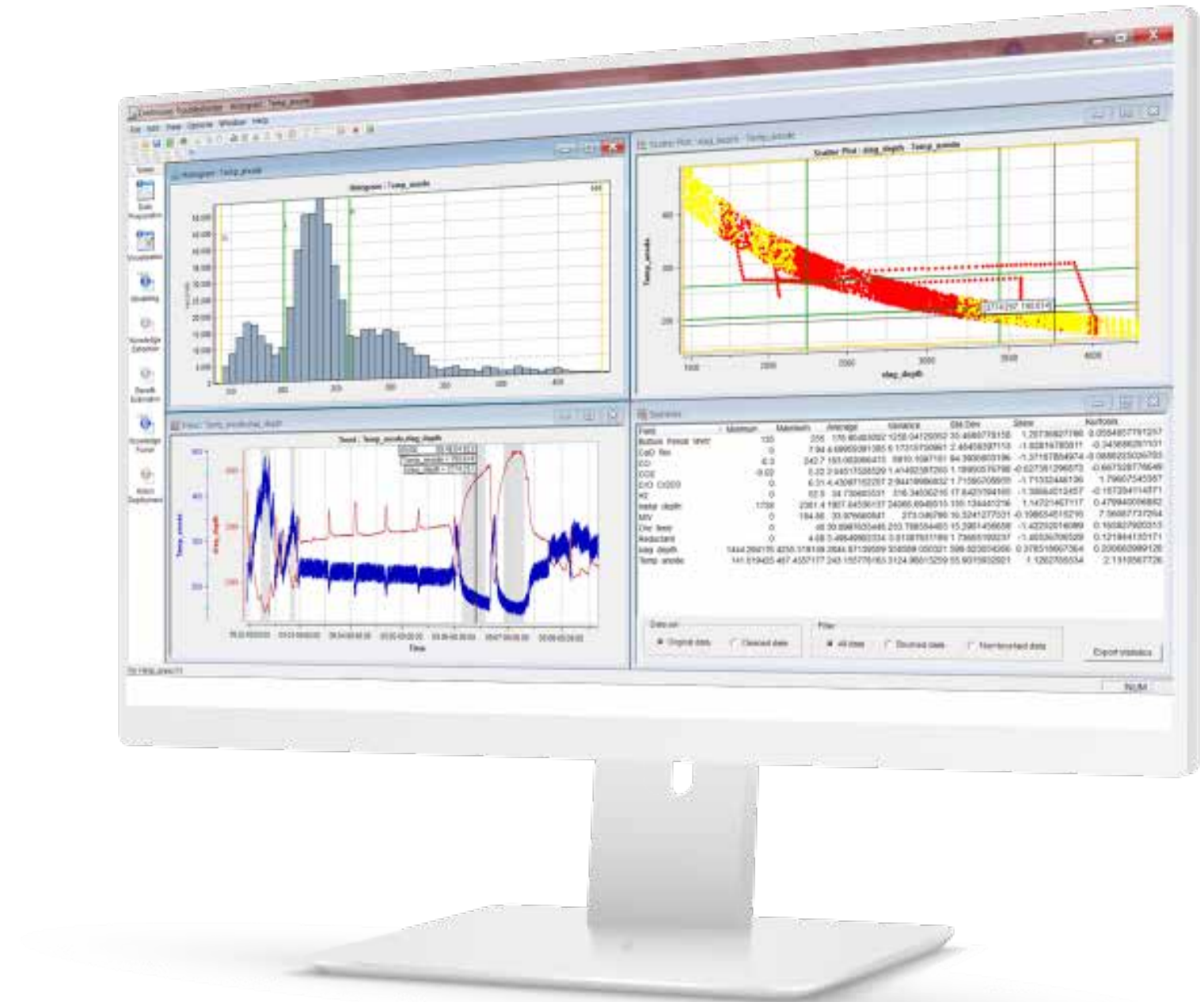
↓ 45%

Decrease in variation in cyclone feed pressure

Solution Overview

The mine performance solution using GE Digital's Proficy CSense analytics software was initially implemented at the filter and drying section of the Lonmin smelter operation to help remove bottlenecks and increase efficiency. Results were so positive that the solution was expanded to include several other sections in the smelter, and it was further expanded to include monitoring of the control systems.

As a next step, Lonmin plans to utilize the predictive analytic capabilities of Proficy CSense to increase uptime and decrease maintenance costs on its fans and blowers.



Filter and drying section

The first section where the Proficy CSense solution was implemented was the filter and drying process.

At the time, concentrate could not be dried fast enough to meet demand from the furnaces.

Operators struggled to juggle the multiple interacting process variables. Excessive process instability due to varying filter cake feed and moisture content in the feed, as well as frequent trips were encountered, increasing the wear-and tear on the equipment. A holistic process control and optimization approach was needed that could not be provided by normal regulatory control.

After GE implemented the process optimization solution on this circuit, throughput increased by more than 10%, consistently reaching maximum design capacity.

Temperatures stabilized and costly trips were eliminated. Even in recent times with depressed metal prices, when throughput is not the main priority, Lonmin continuously uses the solution to ensure that equipment damage and costly inefficiencies do not occur.

Slag concentrator

Another problem area in the smelter was the slag plant, where material from the furnaces are concentrated and recycled back into the process.

Design limitations in this circuit caused major instabilities in the milling section, which impacted the whole concentrator.

Spillages were frequent events, which further wasted production time.

GE's Proficy CSense stabilized the in-mill density and float feed rate and ensured optimal cyclone operation. A performance evaluation post-implementation showed a 25% decrease in variation in the feed and a 45% decrease in

variation in the cyclone feed pressure. Overflows are now a thing of the past.

The overall impact on the stability of the concentrator ultimately led to greater recovery, which is up 1.5%.

Although other factors also played a role, the process-optimization module was a major contributor. Every percent extra recovery in the smelter area has a direct impact on Lonmin's bottom line—saving millions of dollars in metal that would otherwise have been lost.

Off-gas handling plant

The third area where process optimization was applied was the gas cleaning plant, where the offgas from the furnaces and converters is treated.

At this stage, Lonmin had some issues with sulfur dioxide emissions, which exceeded the allowable limit.

The process dynamics were complicated, and there was large variability in the sulfur dioxide concentrations in the feed that the conventional controllers could not handle. This caused large disturbances in the process, which led to high emissions.

The advanced controller stabilized the pH control in the absorber, which brought the emissions back into range. The GE process experts also made some recommendations during the investigation phase that improved overall stability of the plant.

Process monitoring

Lonmin's smelter also uses the monitoring tools and services to optimize the performance of its base-layer (PID) control. The automation manager and his staff can immediately see where the control inefficiencies lie and apply resources where it matters most. They are managing the process proactively, receiving early warnings of changing process and asset conditions. GE process experts also have weekly calls with Lonmin control experts, augmenting the team onsite with GE expertise developed by monitoring a multitude of plants and processes.

The Lonmin plant has seen unprecedented stability in the years since monitoring began.

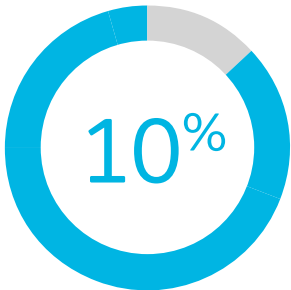
“Without the GE solution, we would incur additional cost for inefficiencies and we will definitely have equipment damage due to our inability to control the process in the same way as an analytically-driven system.”

— **Percy French**

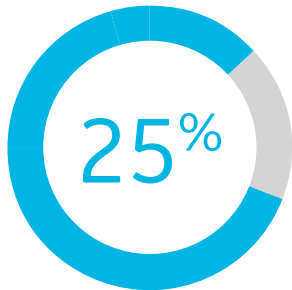
Automation Manager, Smelter, Lonmin

Success on many levels

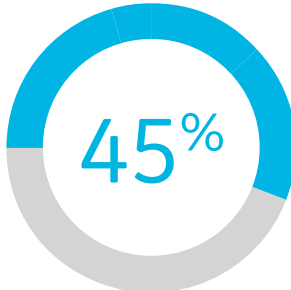
Although there were some normal change-management challenges with the real-time optimization modules, the software now is an integral part of the Lonmin smelter operation, with operators being heavily reliant on the solution to run the process optimally. The solution has been able to provide significant value throughout the Lonmin smelter:



increase in throughput in the filter and drying section



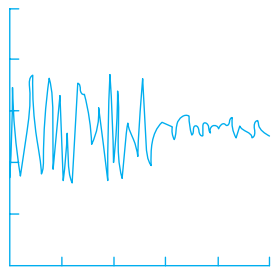
decrease in variation in feed in the slag mill



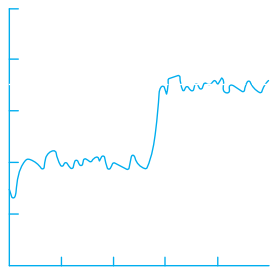
decrease in variation in cyclone feed pressure



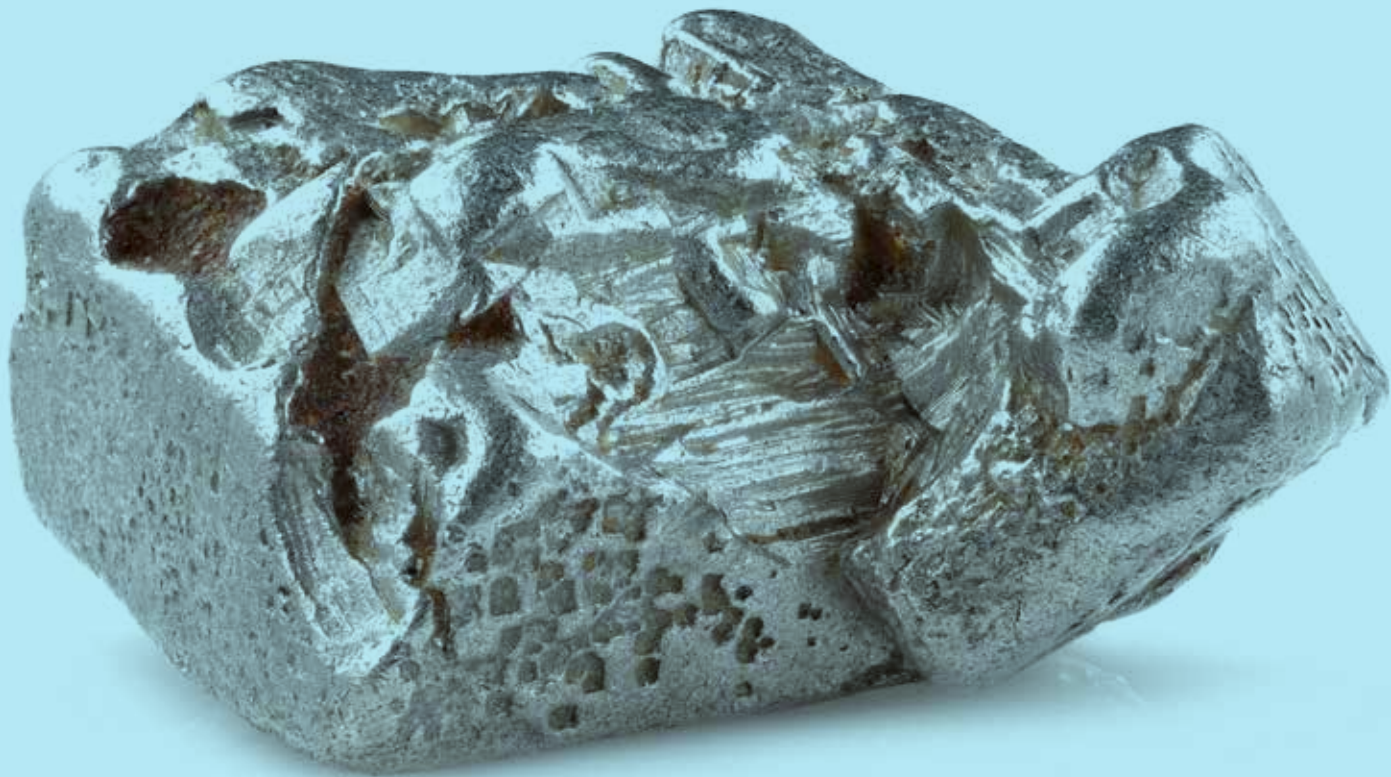
Geater recovery in the slag plant



Stabilization of pH control in the absorber in the gas cleaning plant



Optimization of performance of baselayer (PID) control

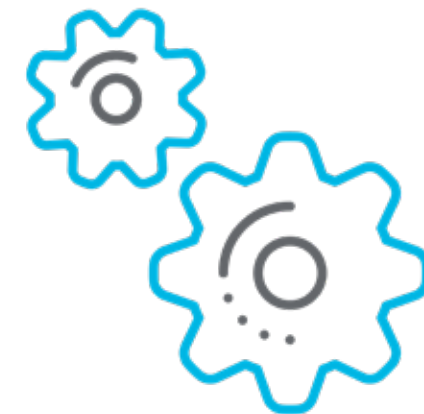


Plans for continued improvement

According to Percy French, Automation Manager at the smelter at Lonmin, Proficy CSense has helped him to “highlight more and more potential areas for improvement.” As a next step, he plans to implement the predictive monitoring capability of the solution on some of the smelter’s critical equipment, including fans and blowers, to help reduce failures and prioritize maintenance.

“The software is running and the people are used to it, it’s very difficult to manage without it.”

— **Percy French**
Automation Manager, Smelter, Lonmin



North American Pharmaceutical Company

Implements electronic quality checks and corrective actions



North American Pharmaceutical Company

Electronic Quality Check

Corrective Actions On Out-of-Spec Product

A lack of efficiency with manual/paper processes meant that the company experienced slow resolution of quality issues. Operators were doing quality checks manually with a paper grid. Proficy Workflow improved efficiency by automating the quality checks and initiating corrective action— as an addition to the company's existing GE Digital HMI/SCADA systems. Proficy Historian provides data collection, archiving, and distribution for analysis. The company also uses Proficy Plant Applications as its standard Manufacturing Execution System (MES) along with Proficy Batch Execution. Proficy CSense includes a closed-loop with analysis for process optimization.



Solutions

- Proficy Workflow
- iFIX HMI/SCADA
- Proficy Batch Execution
- CIMPLICITY HMI/SCADA
- Proficy Plant Applications
- Proficy Historian
- Proficy CSense
- Proficy Webpace

Results

- Improved efficiency
- Reduced waste and costs
- Better quality information
- Faster resolution of quality issues



Positive changes in Rockwool

Proficy CSense's Troubleshooter advances Rockwool's capacity for process analysis

About Rockwell

The ROCKWOOL Group is the world's leading supplier of innovative products and systems based on stone wool, improving the environment and the quality of life for millions of people.



“A year ago, one of my employees enthusiastically told me about a software system for process analysis, Proficy CSense's Troubleshooter, which he discovered at a seminar. It was his opinion that it was exactly something like that, we needed in our department.”

— Mogens Heine Larsen,
Section Manager, Process & Quality Service,
Rockwool International A/S

Our division is called Process & Quality Service, POP, and consists of eleven highly experienced process experts, all working for Rockwool International in Hedehusene. Half of them are based at our factories around Europe, traveling to our various production lines in the world. The experts' tasks include helping our subsidiaries to solve problems with raw materials, processes and quality controls. Our consultants are all highly experienced, almost as if they have a built-in Proficy CSense, which decreases the daily needs. However, there is a need for new analytical tools that can provide new insights and help to “adjust myths”. The tool should not require deeper mathematical insights or to be difficult to use. We have now found all that we look for in Proficy CSense's Troubleshooter, working with GE Digital partner, Novotek.

New Usage

We expect to make a great use of Troubleshooter to a whole new production process in our new factories, while at same use it in our existing environments. We also have a large ongoing project for automatic control of a complex production process, including environmental facilities. An unexpected and very interesting use, currently being investigated together with Novotek, of Proficy is the possibility to simulate a production process in a simulator. This can be used for training our operators before they control the actual process. The “proof of concept” has been

“There is no doubt that this software has a quick return on investment due to better analysis and optimization of processes.”

— Mogens Heine Larsen

completed and we will continue by presenting the idea to the Directors who have the overall responsibility for training in correlation to introduction of new factories and production lines.



Solutions:

Process optimization

Benefits: *Better analysis and optimization of processes*



Rockwool, A Global Leader

The Group is amongst the global leaders within the insulation industry. Together with other building-related products such as acoustic ceilings, cladding boards and consultancy business, the Group ensures energy efficient and fire-safe buildings with good acoustics and a comfortable indoor climate. We create green solutions for the horticultural industry, inventive special fibres for industrial use, effective insulation for the process industry and marine and offshore as well as noise and vibration systems for modern infrastructure.

The software has paid for itself

We have chosen a setting where Proficy CSense's Troubleshooter is on a server, accessible to all consultants. However, only one user at a time can access the information, on the one license available. Getting all data was challenging at first, but once we got everything in order; it was easy to transfer between our systems. There is no doubt that the software has paid for itself as we got better analysis and optimization from our processes.

The possibility to analyze data from production has evolved from simple trending to a complete overview of the significance and correlation of these data. Proficy CSense is a tool that through the application of advanced mathematical algorithms, at the same time being easy for the user to use, gives an insight into the process that previously has not been available.

**Mogens Heine Larsen, Section
Manager, Process & Quality Service,
Rockwool International A/S**



Use your industrial data in an easy way

Proficy CSense enables engineers and operators to use the data from production to avoid mistakes and create simulations.

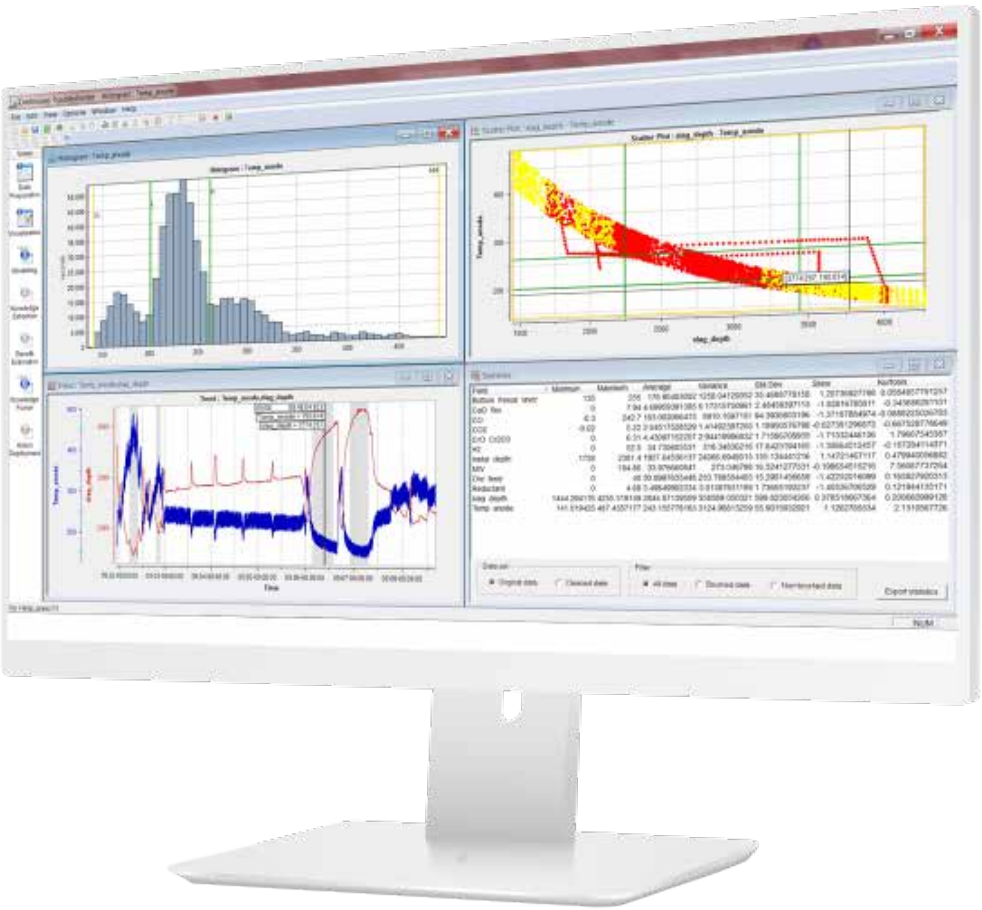
The result is knowledge of how and what is needed to improve the quality and yield of the production process, by using historical data, hence knowledge, intelligently to make it possible to identify the causes of the problems and variations in the process.

Prevent Recurring Problems

With Proficy CSense, you can now prevent future problems from happening by using modeling and thereby the ability to predict how the process will be developed. Proficy CSense can be used in wholesale, manufacturing and continuous process.

Numerous Usages

With the use of Proficy CSense and Troubleshooter, you can visualize process problems and their causes through modeling and simulation based on historical data. Proficy CSense becomes a digital Process Twin facilitating process intelligence and optimization. It requires knowledge of the actual process, but no knowledge about modeling, PCA etc., as this is not visible to the user.



Proficy CSense works with most historians on the market. Even data from relational databases and text files can be used. This gives the users more data to work with in the multivariate analysis of historical data.

With Proficy Troubleshooter you can:

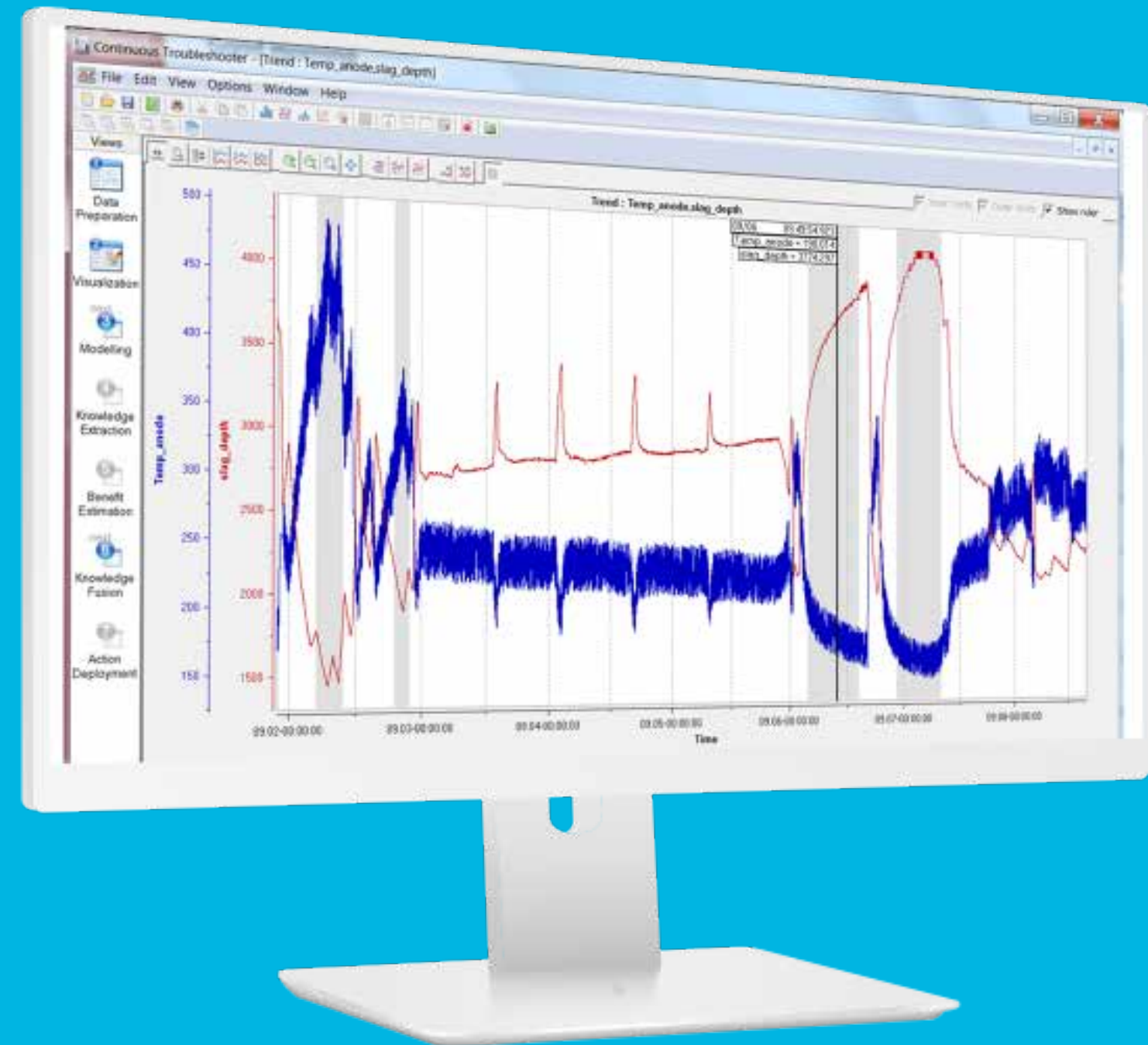
- Identify the likely causes of process problems and variations
- Identify process rules automatically based on historical data
- Identify correlations between variables
- Estimate the benefits of an online real-time solution
- Build and simulate the real-time solution

After the collected data is transformed into intelligent knowledge, it is used to find causes of process problems and variations, and to take real time corrective actions.

Decision support for operators

Proficy CSense can, by using the models, provide feedback in real time on process events and thereby avoid discrepancies and errors. You can, step by step, expand the decision support for operators—directly integrated in the iFIX and CIMPLICITY HMI/SCADA screens or other HMI/SCADA software. As these decisions and guidance have proven its value, you can continue to expand with real-time control.

With Proficy CSense, we can ensure that operators and process engineers get immediate insight into the process status, the rules that drives the process in its current status, as well as identifying the process values that have the greatest impact right now. This is possible through a specially developed real-time component and provides a unique opportunity for operators and process engineers to constantly be alert and to avoid errors. The loop has been closed and we have now enhanced the intelligent HMI/SCADA system.





About GE

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry.

Contact Information

www.ge.com/digital

