

# A self-operating mill? Big thinking and big results at

# ELDOR

Autonomous automobiles use a variety of techniques to gather data about their surroundings and feed this data to advanced control systems that interpret the inputs and identify appropriate navigation paths. The development of autonomous pulp mills using Metris OPP is following a similar path – and Eldorado Celulose is an early adopter of this technology. The results have a big economic payback.







# ADO

## FACTS

**Company:**

Eldorado Celulose

**Location:**

Três Lagoas, Brazil

**Product:**

Bleached market pulp  
(1.7 million adt/a)

**Automation tool:**

Metris OPP





Experiments began with automated operation back in the 1920s or even earlier. The first truly autonomous cars appeared in the 1980s. The development of autonomous mills is moving at a much faster pace thanks to smart sensors and tremendous computing power in small packages that are part of ANDRITZ's Metris OPP (Optimization of Process Performance).



The control room at Eldorado is the action center for production control. OPP software resides in the DCS for advanced control of fiberline processes and also links process, maintenance, and asset management information into one network.

Metris OPP is a combination of sophisticated software and knowledgeable human experts. This system is aimed at improving production through data mining and control strategies, with the goal of reducing costs and increasing profits. It has been around in various forms for over a decade and is constantly evolving and improving. Metris OPP has been implemented in over 50 plants in 14 countries. Arguably the most impressive Metris OPP project is the autonomous mill at Eldorado Celulose near Três Lagoas (MS), Brazil.

#### AUTOMATED OR AUTONOMOUS?

"Autonomous implies acting independently," explains Leonardo Soares Figueiredo, ANDRITZ's OPP Project Manager at Eldorado.

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**Carlos Monteiro,**  
Industrial Director, Eldorado Celulose

do. "Most of our work at Eldorado to date still has an operator in the driver's seat, so perhaps 'automated mill' more accurately describes what we are doing today – with an eye towards autonomy in the future."

Carlos Monteiro, Eldorado's Industrial Director, does not care whether it is autonomous or automated. Monteiro is focused on results.



Arthur Santos, ANDRITZ OPP Analyst (left), gives a progress update to Carlos Monteiro, Eldorado's Industrial Director, while touring the fiberline. According to Monteiro, OPP has made a "big difference" in Eldorado's performance.

"I can tell you this," he says. "The results in the first year have been impressive."

An increase in operational efficiency from 89.2 to 93%; variable cost reduction of 7%; 38,000 admt production over the budgeted amount; AND controls in automatic mode 95% of the time.

#### **METRIS OPP**

Increasing operating efficiency by 3.8% may not sound like a tremendous improvement. But in a mill currently producing 1.7 mill t/a – that amount is equivalent to millions of Brazilian real in the end. The fact that Eldorado operates sustainably at 13% above design capacity without any additional capital investments is proof of its efficiency.

But why would a mill already operating in the top tier choose a service like Metris OPP? "We are well-managed and have tight cost controls," says Leonardo Pimenta, Technical Control Manager at Eldorado and in charge of the OPP project. "But we can always improve our position. We focus on every detail to stay ahead of our competitors. Metris OPP is a tool that helps us stay ahead."

#### **STEP-BY-STEP TRANSFORMATION**

The high level of automation at Eldorado didn't come over night. All changes within the processes of the mill were and are done step-by-step and executed on a daily basis. The advantage of this approach is seen in

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the smooth, gradual integration of the process improvements without impacting daily mill routines.

"The main challenge was never the engineering itself, but rather the adjustments required in the way that operators and managers worked," Figueiredo says.

"The key to us achieving results is the belief that processes are better controlled by automatic, advanced process control than by manual operator intervention," says Pimenta. "Stability is essential. Every loop in automatic mode makes us money."

#### **KPIS ARE MEASURED CONSTANTLY**

"They were pretty high targets, especially for a well-run mill," Figueiredo admits. "But we were committed – both Eldorado and us – to achieving them. We signed an agreement in August 2016 with the idea that we would have all the front-end work done by the end of the year so we could start measuring results in January 2017." »





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Early in the project, Eldorado and ANDRITZ set clear goals against which to measure success. These goals, known as Key Performance Indicators (KPIs), form the basis for 30% of ANDRITZ's payment, so they are important. What gets measured gets done.

The three KPIs selected as being most critical are: 1) operational stability in the 90-93% range; 2) a reduction in variable costs versus budget; and 3) all the APC routines will be turned on at least 90% of the time.

Arthur Santos, OPP Technical Specialist at ANDRITZ, believes that the front-end work of analyzing control loops and then "tuning" each loop is responsible for helping achieve the results Eldorado is seeing today. "It all starts with reliable data, which comes from reliable instruments and sensors," Santos says. "We completed over 40 projects using combinations of smart sensors, APC, loop tuning, data mining, and so on that created the infrastructure and a standardized way of operating."

#### ALMOST 100% AUTOMATED CONTROL

Today, the Eldorado mill runs in automatic mode 97-98% of the time, enabling Eldorado to progress from basic control to "hands off" and even "eyes off" operation. However, operators mostly still start and stop the production process and take over when malfunctions or breakdowns occur, which accounts

for the remaining 2-3% of control tasks. For the rest of their shift, operators can safely turn their attention away from mundane control tasks. "By running in auto, we can re-assign operators to more highly leveraged tasks," Pimenta says. "If you think about it, even the best operator in the world can't be alert and on-duty 24/7/365.



Tiago Garcia (Utilities DCS Operator), Douglas Freitas (Power Boiler DCS Operator), Adriano Cabral (Automation Analyst) and José Spadon Jr. (Fiber Line DCS Operator)

**In less than one year, some important milestones were achieved: a new record for quarterly production from January to March; a new monthly production record in May; a new quarterly production record from April to June; and in August a new average production record.**



Eldorado Celulose's senior management team (left to right): Luiz Roberto Araujo, Maintenance; Marcos Steyer, Woodyard and Chip Preparation; Murilo Sanches, Recovery, Utilities and Energy; Leonardo Pimenta, Technical Control Manager; and Marcelo Martins, Production Manager.



### **AUTOMATIC START-UP SEQUENCES**

At the bleach plant, an automatic start-up sequence has been implemented and tested. "The operators only have to press one button, and the plant starts up by itself," Santos says. "After the process has started, Metris OPP takes over to control bleach production. The expansion of this sequence within our autonomous mill has reaped tangible rewards already, which is why we are now developing similar start-up control for the washing processes."

### **SUPPORT FOR RISK-BASED MAINTENANCE**

Three reliability engineers are part of the ANDRITZ-Eldorado team working on the Metris OPP project. According to Luiz Roberto Araujo, Eldorado's Maintenance Manager, these three are supporting the mill's culture of risk-based maintenance (RBM) by centralizing information from the process and the equipment in the same database.

It sounds simple, but the amount of work is quite challenging. ANDRITZ OPP analysts have tapped into the mill's SAP maintenance

planning software to retrieve vital information on Eldorado's 23,000 assets in the database and combine this with process info from the DCS. The whole team is working on making this communication between the databases mutual.

"This gives us a new level of knowledge about our assets," Araujo says. "Understanding the process is fundamental to understanding the health of our mill. Identifying the risks early prevents unplanned stoppages." Each asset has been categorized A, B, C, or D, depending upon the critical importance of the equipment to the mill's operations. "We monitor the risks for each asset and focus our attention on the highest-priority risks to our most critical assets," Araujo explains. "One glance at a computer screen shows us where to focus our efforts to avoid unnecessary shutdowns."

The result? "We're operating at 95% overall equipment availability," Araujo says. "That is an excellent result." »



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### METRIS OPP MAKES A BIG DIFFERENCE

According to Monteiro, Metris OPP has made a "big difference" in Eldorado's performance. "We have achieved excellent results in just a short time," he says. "Every loop in APC makes us money. Selfishly, I would prefer if no other pulp mills were to investigate Metris OPP. But even if there are some who do, we intend to keep pushing and to stay ahead."

"I suppose there are some people who believe that the Industrial Internet of Things (IIoT) is just a marketing gimmick," says Daniel Schuck, Vice President of Technology for ANDRITZ APO. "Maybe they said the same thing about transmitters and the early distributed control systems. But what we are doing is not pie-in-the-sky fantasy. We are using new tools to do traditional things – saving mills millions of dollars a year."

"We might have tried to do some of this alone, but we chose to bring in an experienced partner with ANDRITZ," Pimenta says. "They have the tools and the experience to help us reach a much higher level of performance faster. Our results show that there is a lot to be gained by extracting the hidden capacity from our assets before having to make additional capital investments."

### ONGOING PROJECTS

Another project is currently underway to determine the best production mill balance at any given time. "Think of it as level control for the entire mill," says Santos. "We are writing software to monitor all the tank levels in the mill and combine this info with key process variables. This software will be crucial in



achieving a higher level of autonomy of the mill because then we will have a powerful tool that will manage production throughout the mill using real-time data."

The mill is also working on an Augmented Reality project to help maintenance staff obtain instant information in the field simply by looking at a piece of equipment with Augmented Reality glasses. At the moment, Eldorado has made considerable progress in making checklists available for operators and maintenance people on their mobile devices.

In addition, there are Metris OPP projects to optimize ash leaching, dissolving tank TTA, lime kiln energy efficiency, and other control strategies being developed. Creation of machine learning tools, automated data analytics to predict process disruptions, and two-way-communication between Metris OPP and the SAP software of the mill are also in progress.

### "PUT ALL OUR EFFORTS INTO THIS"

There are various "flavors" of Metris OPP in various plants. The one thing they have in common is that the work is performed in collaboration with mill personnel – operators, technical resources, and management.



Leonardo Pimenta, Technical Control Manager, meets with the OPP team to discuss progress. The team consists of Eldorado process engineers, reliability engineers, and ANDRITZ OPP analysts working side-by-side.

Eldorado is unique in that a joint team was formed – ANDRITZ and Eldorado personnel -- from the very beginning and works together every day.

"You can find Eldorado process and maintenance reliability engineers and ANDRITZ OPP analysts in the same room," Santos says. "We interact constantly, collaborating and solving problems together."

"We have put all our efforts into the success of this project," Monteiro says. "I don't think there are other mills working this way with a team of committed resources on a full-time basis."

According to Pimenta, when Eldorado decided to go with OPP, it did so in a big way. "We chose to apply all the concepts and all the technologies that OPP offers at the same time," he says. "We didn't want to do it in pieces, but all at the same time and as quickly as possible. That's the Eldorado way." •

#### FOUR FACTS



**98%**  
AUTOMATIC MODE



**+3%**  
OPERATIONAL STABILITY



**AUTOMATED  
START-UP  
SEQUENCES**



**7%**  
REDUCTION OF CHEMICAL  
AND ENERGY COSTS