Process performance for Pulp and Paper
A key component in the digitalization of your pulp and paper plant. Directly improve on sustainability, yield and energy KPIs with focused control and optimization libraries that are flexible, proven and operator friendly.

OPT800 is a complete Advanced Process Controls solution for the pulp and paper industry. Focusing on stabilizing operations whilst seeking out opportunities to maximize yield and reduce consumables – including pulp brightness, liquor quality, steam, energy and more.

Why pulp and paper process optimization from ABB?

**OPT800 Bleach:**
Stabilize and optimize bleach operations in real time. Tightly control Kappa reduction to preserve pulp quality, while minimizing consumables and formation of chloro-lignin compounds. Enabling you to consistently reach your brightness targets.

**Typical Benefits:**
- Reduced pulp brightness variation by up to 50%
- Reduced chemical consumption by up to 10%
- Improved pulp quality and yield

**OPT800 Lime:**
Advanced control for lime production. Automatically analyze residual carbonates during laboratory tests to optimize control targets. Improving uniform lime quality with low energy consumption and reduced emissions.

**Typical Benefits:**
- Reduced excess oxygen variation by up to 60%
- Reduced fuel consumption
- Improved re-burned lime quality

**OPT800 Oxygen:**
Optimize oxygen/alkali charge ratios and H-factor. Balance the removal of maximum lignin in the oxygen stage while maintaining optimum pulp strength. Making it easier to produce high quality pulp at low chemical consumption and environmental impact.

**Typical Benefits:**
- Reduced outlet Kappa variations by up to 50%
- Reduced chemical usage in bleach plant by up to 10%
- Smoother grade changes

**OPT800 Caust:**
Superior control and monitoring of the causticizing process. Stabilize white liquor quality and manage green liquor TTA, causticizing efficiency and production rate changes. Helping mill personnel improve process efficiency and quality.

**Typical Benefits:**
- Increased causticizing efficiency by 0.5-1.5 units
- Decreased causticizing variation by up to 60%
- Improved white liquor quality and strength

**OPT800 Cook/B:**
Optimal cooking conditions for all chips charged to each digester. Multivariable control facilitates decreased variation in pulp quality and steam demand. Helping automate the adjustment of steam demands and requirements of each digester.

**Typical Benefits:**
- Increased capacity (2-7%)
- Reduced energy consumption (5-20%)
- Decreased steam flow variations (30-70%)

**OPT800 Cook/C:**
Control, optimize and monitor continuous digesters. Stabilize chip column movement and standardize cooking history for all chips. Directly reducing kappa variability and raw material consumption.

**Typical Benefits:**
- Increased production (1-5%)
- Reduced kappa variation (25-50%)
- Lower consumption of energy and bleaching chemicals

**OPT800 Wash:**
Automatically control and maintain stable brown stock washing conditions and filtrate tank levels. Constantly seeks opportunities to reduce specific consumption of water, chemical and steam. Increasing overall production whilst decreasing environmental impact.

**Typical Benefits:**
- Increased capacity by 1-4%
- Lower soda/alkali losses
- Reduced wash water consumption by 1-5%
Efficient running of pulp bleaching stages is often challenging for operators, who must control numerous reactions to consistently hit final brightness targets, while also preserving the fiber strength (pulp viscosity). It’s a delicate balancing act that is influenced by many dynamic variables, both in the bleaching stages and also by the preceding digester and oxygen operations. Getting stable runs can require frequent operator intervention.

At the same time, poor performance of the bleaching stages can have significant negative impact on both pulp quality and bleaching chemical costs. Furthermore, disturbances due to variations in wood species, chip quality, pulp grades and production rates add to the complexity of pulp bleaching. Because of the nature and dynamics of delignification processes, it can take only a few minutes to destabilize bleach lines – and then several hours to recover.

OPT800 Bleach tightly controls Kappa to preserve pulp quality during the bleaching phase. In the subsequent stages, brightness and chemical residuals are tightly controlled. Mills can better meet their brightness targets - with 30-50% lower brightness variation and 3-10% lower chemical costs.

Features
- Kappa, pH and final brightness control
- Production rate and grade change controls
- Pulp tracking and pulp quality footprint
- Real-time adaptive modelling: Automatic adjustments based on process changes
- Higher-order model support: Captures process dynamics accurately
- Cost optimizer: Looks for ways to optimize operational costs within process constraints
- Automatically manages smoother grade and production rate changes

Benefits
- Reduced pulp brightness variation by up to 50%
- Reduced chemical consumption by up to 10%
- Reduced chemical residuals
- Reduced pulp strength variation
- Improved pulp quality and yield
- Reduced environmental impact
- Improved diagnostic capability using pulp tracking function

How it works - Keeping bleaching in balance
To smooth out bleach plant operation, OPT800 Bleach manages and controls production rate and grade changes, ensuring smooth transitions. The Pulp Tracking module continuously aids in monitoring, analyzing and optimizing the complete process by tracking key process parameters through the various bleaching stages and adjusting as needed.

OPT800 Bleach utilizes a model based predictive control approach to accurately capture process dynamics. It manipulates chemical charges proactively to stabilize pulp brightness while minimizing bleaching chemical consumption. Control performance will not degrade over time with always-on monitoring and analysis of the APC solution. The control system can be applied to different types of bleach plants with a variety of bleaching sequences, including all ECF and TCF processes.
Real-time adaptive modelling
Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models (covering the digester, oxygen, bleaching, washing, causticizing and lime operations) are dynamically updated if the process conditions change for things like grade changes, production rate changes, high inlet Kappa, etc. If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent.

Pulp Tracking function accurately compensates for retention times
Pulp Tracking accepts various process and quality measurements upstream from the oxygen delignification stage and tracks them through the various sections of the process such as the unbleached storage tank, various bleaching reaction towers and blow tanks, filtrate tanks and final high density storage towers.

The tracked process variables are used to develop non-linear empirical models of key quality variables such as pulp brightness that are then used for tighter closed loop control of bleaching chemicals and final brightness. The function accurately captures the process delays and retention times in the storage tanks and bleaching reactors, which are critical to tight control of first stage Kappa number and final brightness. It also provides insights during swings in pulp quality and improves the process diagnostic capabilities. Pulp tracking also facilitates automated grade changes in the brown stock and oxygen delignification processes.

Pulp Brightness Virtual Measurement
OPT800 Bleach includes a Pulp Brightness Virtual Measurement. Also known as a soft sensor, the Pulp Brightness Virtual Measurement utilizes models generated from machine learning technologies to predict an online measurement in order to increase the frequency of brightness measurements. These real-time calculations provide insight into the brightness factor at a faster rate than standard measurement devices and at various locations throughout the process.

This, when paired with the tracking function, gives operators a complete profile of brightness through the various zones of the bleaching stages, helping to close the brightness control loop and reduced variability and rejects.

Operator displays and reports
Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends data as well as modify tuning parameters. OPT800 Bleach allows customization of the user interface to meet a wide range of project needs. The reports module calculates the key performance indicators such as controls utilization, and steam consumption, and presents them in the day/shift report. OPT800 Bleach is delivered as a subscription based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.
In operation of the causticizing process, the main objective is to maintain stable white liquor production rate and quality. The specific challenge is to achieve optimal chemical conversion in the causticizing reaction, enabling a high causticizing efficiency while ensuring easy separation of the lime mud.

Disturbances such as changes in green liquor quality, lime availability and production rate add to the complexity of the problem. Poor performance of the causticizing process can have significant impacts on the white liquor quality, which can cause larger quality and production rate disturbances throughout the cooking process.

OPT800 Caust, an ABB Ability™ Advanced Process Control (APC) solution, solves these challenges by providing tighter control of the causticizing process, reducing variability for better white liquor quality while also increasing capacity by up to 7%.

**Features**
- Production change control
- Green liquor TTA control
- Causticizing efficiency control
- Real-time adaptive modelling: Automatic adjustments based on process changes
- Higher-order model support: Captures process dynamics accurately
- Cost optimizer: Looks for ways to optimize operational costs within process constraints
- KPI dashboard and control usage reports by day/shift
- Performance monitoring, with both on-site and remote access for customer and ABB
- Task-oriented, user-friendly and customizable operator displays

**Benefits**
- Increased causticizing efficiency by 0.5-1.5 units
- Decreased causticizing variation by up to 60%
- Improved white liquor quality and strength
- Increased capacity by 3-7%
- Decreased lime consumption
- Optimized lime mud separation and washing

**How it works – Maintaining white liquor quality, efficiency and costs**
The OPT800 Caust control application stabilizes white liquor production and quality by controlling the green liquor TTA, causticizing efficiency and production rate changes. The APC solution maintains a stable causticizing efficiency by optimally adjusting the lime-to-green liquor ratio and green liquor density while simultaneously accounting for the slaker differential temperature. Production rate changes are carried out smoothly as the production rate control coordinates the various operating parameters (i.e. flows and temperatures) to ensure minimal disturbance to the system. Control performance will not degrade over time with always-on monitoring and analysis of the APC solution.

The program maintains a stable causticizing efficiency by optimally adjusting the lime-to-green-liquor ratio and green liquor density while simultaneously accounting for the slaker differential temperature. Production rate changes are carried out smoothly as the Production Rate Control coordinates the various operating parameters (flows and temperatures) to ensure minimal disturbance to the system.
Real-time adaptive modelling
Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models are dynamically updated if the process conditions change for things like production rate changes, lime quality changes, etc. If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent.

Causticizing Efficiency Virtual Measurement
OPT800 Caust includes the Causticizing Efficiency Virtual Measurement. Also known as a soft sensor, this Virtual Measurement utilizes models generated from machine learning technologies to predict an online calculation in order to increase the frequency of measurements.

These real-time calculations provide insight into the causticizing efficiency at a faster rate than standard measurement devices and at additional locations, such as after the slaker or first causticizer.

These more frequent measurements enable the balancing of the lime-to-green liquor ratio with a closed loop control strategy—reducing variability and rejects while improving overall operation of the causticizers.

Operator displays and reports
Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends data as well as and modify tuning parameters. OPT800 Caust allows customization of the user interface to meet a wide range of project needs. The reports module calculates the key performance indicators such as controls utilization, white liquor quality and lime consumption, and presents them in the day/shift report. OPT800 Caust is delivered as a subscription-based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.

800 Caust helped a European kraft pulp mill reduce causticizing efficiency ability by 61.7%.
Batch cooking methods present numerous operational challenges to pulp line personnel. The ability to produce consistent quality cooks at uniform production rates depends on how well the cooking process sticks to the schedule. Furthermore, it is desirable to optimize steam utilization. Thus, digester house scheduling, production rate control and steam management are intertwined variables that play a crucial role in ensuring steady operation and uniform production.

OPT800 Cook/B is an ABB Ability™ Advanced Process Control (APC) solution for controlling, monitoring and reporting on batch digester house operations for overall cooking optimization. It’s accomplished by maintaining a steady Kappa number and even cooking by using the built-in Kappa control module that works in sync with the H-factor control.

This APC solution can be applied to different types of digester houses including direct/indirect steaming, cold blow and displacement cooking methods such as Rapid Displacement Heating (RDH) or SuperBatch, varying cooking sequences, special batch digester house configurations and for both the sulphate and sulfite processes. The result is consistently high pulp quality coming out of the entire batch digester house, with the lowest raw material and energy inputs.

**Features**
- Production rate control and scheduling
- Steam leveling
- Quality control
- Grade change controls
- Cook batch scheduler
- Cook time/temperature optimization
- KPI dashboard and control usage reports by day/shift
- Performance monitoring, with both on-site and remote access for customers and ABB
- Task-oriented, user-friendly and customizable operator displays

**Benefits**
- Increased capacity (2-7%)
- Decreased Kappa variations (20-50%)
- Reduced energy consumption (5-20%)
- Reduced chemical consumption (2-9%)
- Decreased steam flow variations (30-70%)
- Smoother production, species, and/or grade changes
- Reduced environmental load
- Fewer headaches managing the batch digester

**How it works - Production rate and scheduling**
Production rate in the digester house is governed by the amount of steam available and amount of time between cooks. Production Rate Control determines the best spacing between cooks while considering the constraints – the number of digesters in service and the maximum amount of steam available – to achieve the desired production rate from the digester house. The control performance will not degrade over time with always-on monitoring and analysis of the APC solution.

OPT800 Cook/B plays an important role in achieving desired production levels; its scheduler feature predicts events in the digester house over the coming three-to-four hour horizon. This assists operators who can use this predictive information to update the schedule and avoid “collisions” due to unexpected delays.
Cooking time/temperature optimization
This feature in OPT800 Cook/B maximizes the usage of available cooking time by minimizing the cooking temperature. Lower cooking temperature results in energy savings as well as improved quality due to milder cooking conditions. The APC solution enables necessary impregnation time by adjusting the temperature bring-up time to its optimum value within established limits.

The control uses numerical optimization methods to ensure that the temperature is minimized while the target H-factor is still achieved in the given cooking time available. For instance, if excess time is available and the digester is scheduled to cook at its minimum allowed temperature, OPT800 Cook/B will automatically extend the bring-up and cook times to maximize impregnation.

Steam leveling
Steam leveling or steam smoothing control provided by OPT800 Cook/B is based on an adaptive steam flow control concept. It continuously adapts the steam flow target to the actual demand in the digesters and minimizes instantaneous variations in the total steam flow. This feature calculates the total steam flow setpoint along with the individual digester steam flow targets to give exceptional control of steam flow magnitudes and rates while maintaining the required quality control targets. The desired level of steam flow leveling can be easily adjusted through the operator display.

Pulp quality control
Quality and yield – the pulp maker’s two most important goals – are achieved by cooking exactly to the grade specification targets. The pulp quality tests (Kappa, K-number etc.) entered by the operators are used by the Kappa control module to adjust the grade specific targets for the H-factor and/or alkali-to-wood ratio. Corrections to the H-factor target are made automatically after a test entry. The “modified H-factor” is used to calculate the correct temperature, blowing time, reaction rates, etc. to maintain quality and yield within the desired limits. The required quality/yield is adjustable through the grade recipes, which include cooking parameters and targets.

Operator displays and reports
Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends as well as modify tuning parameters. Using OPT800 Cook/B, operators can create their own displays using the predefined graphical elements to meet their specific needs. The reports module calculates the key performance indicators for cooking cycle time, raw materials (wood, liquor and steam) and quality indicators such as Kappa, H-factor, etc. OPT800 Cook/B is delivered as a subscription based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.
DATASHEET

OPT800 Cook/C
ABB Ability™ Advanced Process Control for continuous digesters

Reduce kappa variability and achieve optimum pulp quality with OPT800 Cook/C, an ABB Ability™ Advanced Process Control solution for controlling and monitoring continuous digesters. By stabilizing the chip column movement, the solution creates a similar cooking history for all chips to decrease pulp quality variations and raw material consumption.

When paired with the Kappa Virtual Measurement, which provides calculated Kappa values in the cooking zone, mills gain more frequent insight into kappa values to make corrections quicker for tighter control.

Improving continuous digester cooking conditions
Producing consistent quality pulp at high production rates is a challenging task for digester operators, particularly in the presence of chip size and moisture variations induced by seasonal changes, geographical factors and the wood source. Moreover, the scheduled swings from hardwood to softwood make the process control task even more complex.

OPT800 Cook/C is an ABB Ability™ Advanced Process Control (APC) solution that controls and monitors continuous digesters. At the core, OPT800 Cook/C stabilizes pulp production, reduces raw material and chemical usage and coordinates the numerous loops to achieve optimum on-specification pulp quality at minimum variance. For bleached grades, this APC solution also helps minimize bleaching chemical usage.

Features
• Digester level, kappa, residual alkali and blow consistency controls for continuous digesters
• Pulp tracking correlates process and operating parameters, from chips to final cooked pulp
• Real-time adaptive modelling: Automatic adjustments based on process changes
• Higher-order model support: Captures process dynamics accurately
• Cost optimizer: Looks for ways to optimize operational costs within process constraints
• Pulp quality profile throughout digester zones

Benefits
• Increased production (1-5%)
• Reduced kappa variation (25-50%)
• Lower alkali consumption (2-5%)
• Increased unbleached pulp yield
• Lower consumption of energy and bleaching chemicals
• Smoother production, grade and/or chip species changes
• Decreased variation in residual alkali

How it works
OPT800 Cook/C stabilizes the chip column movement to create a similar cooking history for all chips by ensuring consistent dwelling time within different zones of the digester. The accurate control of cooking time, alkali dosage and cooking temperature decreases pulp quality variations, and alkali and steam consumption, while improving pulp yield. OPT800 Cook/C is applied as a fully integrated APC solution within 800xA. Once the process is automated and stabilized, chemical and steam usage can be further optimized using automatic target management to find the best economical process constraints - without compromising quality. Available as a service through the ABB Collaborative Operations delivery model, pulp mills can choose to never lose sight of APC performance with always-on monitoring and analysis.
Real-time adaptive modelling
Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models (covering the digester, oxygen, bleaching, washing, causticizing and lime operations) are dynamically updated if the process conditions change for things like grade changes, production rate changes, high inlet Kappa, etc. If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent.

Pulp tracking function
The pulp tracking function accepts various process measurements upstream of the cooking process and tracks them through the various sections of the digester up to the blow line. The tracked process variables are used to develop non-linear empirical models of various quality variables such as kappa and blow consistency. Having a pulp quality profile across the digester provides insights during swings in pulp quality and improves the process diagnostic capabilities.

Kappa Virtual Measurement
Tighter control is achieved with the inclusion of a Kappa Virtual Measurement that helps overcome the bottleneck of infrequent physical measurements by providing visibility into pulp quality across the cooking plant. Also known as a soft sensor, the Kappa Virtual Measurement utilizes mill-specific data inputs and machine learning technologies to generate continuously optimized calculations that predict a Kappa measurement in the upper cook zone of the digester.

Ongoing performance monitoring and optimization tasks maintain and improve the calculation by compensating for any operational changes. The virtual measurement provides more frequent inputs to make any necessary corrections as soon as variation is detected. Plus the impact of making a correction, such as manipulating the H-factor, is immediately visible by how it affects the prediction.

Operator displays and reports
Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends data as well as modify tuning parameters. OPT800 Cook/C allows customization of the user interface to meet a wide range of project needs. The reports module calculates the key performance indicators such as alkali usage, controls utilization, and steam consumption, and presents them in the day/shift report. OPT800 Cook/C is delivered as a subscription-based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.

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The information provided in this data sheet contains descriptions or characterizations of performance that may change as a result of further development of the products. Availability and technical specifications are subject to change without notice.

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OPT800 Lime results in uniform lime quality with low energy consumption and reduced emissions. The Advanced Process Control solution analyzes residual carbonates during laboratory tests to optimize control targets and ultimately produce lime efficiently and economically.

The lime kiln operation in the kraft pulping recovery process, though straightforward in principle, can be challenging to operate at high efficiency. Some of the difficult issues faced by kiln operators include low thermal efficiency, high fuel consumption, process delays, build-up of rings and dust, overheating of refractory, poor quality of lime and increased emissions.

OPT800 Lime manages these challenges to achieve optimum control and efficient lime production. The ABB Ability™ Advanced Process Control (APC) solution works to optimize time production rates; reduce energy consumption and emissions; increase re-burned lime availability; decrease residual carbonate variations; and improve the overall mill operation with increased visibility over the process. It combines laboratory results by operators with model-based predictive control, thus getting the best of both approaches in a fully product-specific solution, with minimum need for on-site development.

**Features**
- Production rate control
- Burning zone temperature control
- Draft control
- Residual carbonate control
- Control usage reports
- Real-time adaptive modelling: Automatic adjustments based on process changes
- Higher-order model support: Captures process dynamics accurately
- Cost optimizer: Looks for ways to optimize operational costs within process constraints
- KPI dashboard and control usage reports by day/shift

**Benefits**
- Increased production rate
- Reduced energy consumption by up to 10%
- Reduced excess oxygen variation by up to 60%
- Reduced lime quality variation
- Reduced fuel consumption
- Improved re-burned lime quality

**How it works – Getting best lime quality and production rates**
OPT800 Lime introduces frequent but small adjustments within the operational limits to obtain continuous optimization, thereby reducing the process variance and improving the overall mill performance. The adjustments are made by controlling the temperature profile, flue gas emissions, lime mud flow and residual carbonates of the refractory. At its core, the APC solution utilizes a model of the kiln process to accurately predict process variable interactions. These lead to smooth and stable mill operation and uniform lime quality. Control performance will not degrade over time with always-on monitoring and analysis of the APC solution.
• **Lime kiln controls** include temperature profile, excess oxygen, mud feed, mud density and fuel flow control. These are used to manage the temperature profile while maintaining re-burned lime quality at optimal levels. This, in turn, extends lime refractory life due to more stable operations and low temperature fluctuations.

• **Production rate control** accounts for the process dynamics and coordinates the ramping up or down of various operating parameters such as the lime mud flow, lime mud density, fuel flow, etc. to ensure minimal quality variation and off-spec lime during production rate changes.

• **Residual carbonate control** is an optional feature of OPT800 Lime to maintain the optimal levels of residual carbonate. Residual carbonates are measured with the help of laboratory analysis and the system monitors long term trends of laboratory test results to provide optimized control targets.

**Real-time adaptive modelling**
Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models (covering the digester, oxygen, bleaching, washing, causticizing and lime operations) are dynamically updated if the process conditions change, for things like grade changes, production rate changes, etc.

If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent.

**Operator displays and reports**
Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends data as well as modify tuning parameters. Using OPT800 Lime, operators can create their own displays using the predefined graphical elements to meet their specific needs.

The reports module calculates the key performance indicators such as controls utilization, heat rate, fuel consumption, and lime quality and presents them in the day/shift report. OPT800 Lime is delivered as a subscription-based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.
Remove maximum lignin in the oxygen stage, while safeguarding optimum pulp strength levels with ABB’s OPT800 Oxygen. By optimizing oxygen/alkali charge ratios and H-factor, even during inlet Kappa variations or grade changes, this Advanced Process Control solution makes it easier to produce high quality pulp at low chemical use and environmental impact. The result is maximum delignification ratio and reduced bleach loads at the lowest possible cost.

Getting ideal pulp quality out of the oxygen delignification process is a balancing act, with operators aiming to achieve maximum lignin removal while preserving the fiber strength (pulp viscosity). Variations in wood species and incoming Kappa, as well as changes in grades and production rates, increase the complexity of the challenge. Poor performance of the oxygen delignification stage can have a significant negative impact on both pulp quality and yield. It can also lead to increased operating costs and effluent discharge, due to higher bleaching chemical consumption.

To solve these challenges, OPT800 Oxygen gives operators superior monitoring and control of the oxygen delignification stage. This ABB Ability™ Advanced Process Control (APC) solution has algorithms tailored to balance and adapt to numerous key variables, which are based on real-time process conditions, to maintain stable and consistent lignin removal. This helps operators achieve a constant delignification ratio, helping to reduce Kappa variations by 30-50% and chemical use by 5-10%.

### Features
- Reactor pH/O₂ charge ratio and temperature control
- Production rate and grade change controls
- Pulp tracking and pulp quality footprint programs
- Automatic Kappa number target adjustment
- Real-time adaptive modelling: Automatic adjustments based on process changes
- Higher-order model support: Captures process dynamics accurately
- Cost optimizer: Looks for ways to optimize operational costs within process constraints

### Benefits
- Effective management of disturbances due to variance in production rates, pulp grade, wood species, or incoming pulp Kappa
- Reduced outlet Kappa variations by up to 50%
- Reduced chemical usage in bleach plant by up to 10%
- Improved pulp quality, consistency and yield
- Smoother grade changes
- Maximum utilization of oxygen delignification before bleaching
- Reduced environmental impact

### How it works - Selectively removing lignin
OPT800 Oxygen facilitates selective removal of lignin at a consistent rate before the bleeding stages by expertly managing the reactions and pH levels via tight control of the oxygen and alkali charges (kg per ton of pulp). It also maintains a constant delignification level by adjusting the outlet Kappa target – based on variations in the incoming Kappa.
The combined result is highly effective lignin removal and lower cellulose degradation, giving a stable outlet Kappa, high pulp strength, better yields, reduced chemical usage and lower environmental impact. In addition, the built-in Pulp Tracking function helps monitor and diagnose any anomalies in the process, while also tracking the key process and pulp properties through the oxygen reactors. Plus, control performance will not degrade over time with always-on monitoring and analysis of the APC solution.

**Real-time adaptive modelling**
Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models (covering the digester, oxygen, bleaching, washing, causticizing and lime operations) are dynamically updated if the process conditions change for things like grade changes, production rate changes, high inlet Kappa, etc. If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent.

**Pulp Tracking function accurately compensates for retention times**
The Pulp Tracking function accepts various process and quality measurements upstream from the oxygen delignification stage and tracks them through the various sections of the process such as blow tank, brown stock washing line, and oxygen reactors up to the unbleached HD tower. The tracked process variables are then used to develop nonlinear empirical models of key quality variables such as pulp viscosity and used for tighter closed-loop control of the delignification ratio.

The function accurately captures the process delays and retention times in the storage tanks and oxygen reactors, which are critical for tight control of the post-oxygen delignification stage Kappa number. It also provides insights during swings in pulp quality and improves the process diagnostic capabilities. Furthermore, Pulp Tracking facilitates automated grade changes in the brown stock and oxygen delignification processes.

**Operator displays and reports**
Highly intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends as well as modify tuning parameters. OPT800 Oxygen allows customization of the user interface to meet a wide range of project needs. The reports module calculates the key performance indicators such as usage of alkali, magnesium sulfate, and oxygen, controls utilization, and steam consumption, and presents them in the day/shift report. OPT800 Oxygen is delivered as a subscription-based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.
DATASHEET

OPT800 Vapor
ABB Ability™ Advanced Process Control for multiple-effect evaporator plants

OPT800 Vapor is an Advanced Process Control (APC) solution for controlling and monitoring of the multiple-effect evaporation plant. Using a multivariable model-based approach, the solution controls the strong liquor production rate and dry solids content to minimize energy consumption and increase evaporation plant capacity.

Black liquor evaporation is a very important part of the recovery process. Dilute black liquor from the pulp mill fiberline is fed to the evaporation section to produce concentrated black liquor. This is then burnt in the recovery boiler to recover the cooking chemicals and produce steam for process heating and generation of electric power. Thus, the evaporation unit provides the link between the fiberline and recovery sections and plays a major role in the operation of pulp mills.

Ensuring the production of strong black liquor with on target dry solids content and minimum variability is the key to stabilizing the recovery section and optimizing steam utilization. The multi-effect evaporators use low and medium steam pressure to transform weak black liquor with a dry solids content of 15-20% into strong black liquor with a dry solids content of 80-85%.

A common trade-off in pulp mills involves balancing the effects of washing on the bleaching process and the evaporation process. Increasing the dilution factor in washing uses more water to produce cleaner pulp, resulting in better bleaching with lesser chemical consumption but increased evaporator loads and more steam consumption. Conversely, decreasing the dilution factor in washing, results in lower evaporator loads and steam consumption, but higher bleaching loads, carryover soda losses and chemical consumption. Thus, there is a delicate balance and finding the sweet spot for pulp mill operations is not trivial.

OPT800 Vapor solves these challenges by providing tighter control of the evaporation process, reducing variability of the black liquor quality while also lowering operating costs and increasing capacity.

Features
- Dry solids control to optimize steam economy and provide higher evaporation capacity
- Production rate controls
- Real-time adaptive modelling: Automatic adjustments based on process changes
- Higher-order model support: Captures process dynamics accurately
- Cost optimizer: Looks for ways to optimize operational costs within process constraints
- Evaporators performance monitoring
- KPI dashboard and control usage reports by day/shift
- Performance monitoring, with both on-site and remote access for customers and ABB
- Task-oriented, user-friendly and customizable operator displays

Benefits
- Increased production rates
- Removes bottlenecks
- Reduced strong liquor dry solids variations
- Decreased energy consumption, enabling steam savings
How it works – Stabilizing black liquor quality and lowering costs

OPT800 Vapor effectively uses a multivariable model-based approach to optimize the black liquor dry solids profile across the multi-effect evaporation process. OPT800 Vapor coordinates the gradual rise of the boiling point of the individual effects (or evaporators) as well as the feed and intermediate liquor flows. By reducing the variability in the black liquor dry solids, the APC solution minimizes overall steam consumption while stabilizing operations. This results in fewer upsets and longer intervals between cleanings.

The included production rate control ensures fast and smooth changes during swings in the production rate by efficiently coordinating the various operating parameters (i.e. flow and boiling point rise) to ensure minimal disturbance to the system. The liquor tank levels are also maintained within desired levels to ensure optimum inventory levels and smooth transitions during disturbances and process upsets. Control performance will not degrade over time with always-on monitoring and analysis of the APC solution.

Real-time adaptive modelling

Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models are dynamically updated if the process conditions change for things like production rate changes, fouled evaporation effects, etc. If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent. Remove bottlenecks Importantly, use of the APC on the evaporator line can help find and implement control strategies to increase the throughput, opening up the bottleneck that the evaporators may be causing. Thus this is an easy way to get higher evaporator capacity, and therefore more black liquor produced in the recovery process and ultimately more pulp, without additional capital expenditure.

Coordinate with OPT800 Wash

OPT800 Vapor can coordinate with OPT800 Wash to optimize the dilution factors in washing and adjust the steam flow within the First Effect, also known as the Concentrator. By working together, these two APC solutions help control steam flow to the first effect, and then monitor solids in the firing liquor tank before the recovery boiler in a feedforward control loop on the countercurrent steam and black liquor flows.

Operator displays and reports

Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends as well as modify tuning parameters. Using OPT800 Vapor, operators can create their own displays using the predefined graphical elements to meet their specific needs. The reports module calculates the key performance indicators such as controls utilization, steam consumption, production and quality and presents them in the day/shift report. OPT800 Vapor is delivered as a subscription-based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.
OPT800 Wash automatically maintains stable brown stock washing conditions and filtrate tank levels to help improve washing process efficiency, increase production and decrease environmental impact. The Advanced Process Control solution stabilizes the process and performance of brown stock washers, optimizing water, chemical and steam consumption.

In brown stock washing operations, a trade-off must be achieved between minimizing residual impurities in the pulp and reducing freshwater consumption. Increased focus on the environment, combined with demands for higher washing efficiency while reducing total cost of operation, has resulted in the need for improved process optimization strategies in pulp mills. In addition, disturbances such as change in wood species and production rate can add to the complexity of brown stock washing challenges. Since washing is a sequential, countercurrent operation, it takes only a few minutes to destabilize the process and then recovery can take several hours. Poor performance of the brown stock washers can significantly affect the broader stability of the pulp mill operations and result in increased operating costs due to both higher energy demand in the evaporators and higher bleaching chemical consumption.

OPT800 Wash helps solve all these issues by computing the optimal dilution factor values and defoamer charge using pulp conductivity measurements, while also considering the limits on the filtrate tank levels. Optimal dilution factors lead to important reductions in alkali/soda losses, black liquor solids and freshwater consumption.

Benefits
- Better washing efficiency
- Better filtrate tank level control
- Increased capacity by 1-4%
- Lower soda/alkali losses
- Reduced wash water consumption by 1-5%
- Decreased chemical loading in bleaching
- Reduced steam consumption in evaporation by 2-10%

How it works – Tightly managing tank levels and conductivities
ABB’s OPT800 Wash is an ABB Ability™ Advanced Process Control (APC) solution that expertly monitors and controls the brown stock washing process on the fiber line. The conductivities at each washing stage are tightly controlled to minimize alkali losses below the allowable high limit. The APC maintains the filtrate or seal tank levels within the specified critical limits. Any deviation of the tank level outside the critical limits will affect the washing rate and efficiency. Control performance will not degrade over time with always-on monitoring and analysis of the APC solution. The system can be applied to different types of washing equipment like filter washers, diffuser washers and wash presses.
Real-time adaptive modelling
Dynamic model adjustment and adaptation in real time is a unique feature to ABB’s APC platform. It means process models (covering the digester, oxygen, bleaching, washing, causticizing and lime operations) are dynamically updated if the process conditions change, for things like grade changes, production rate changes, high inlet Kappa, etc. If any important process condition or property changes, the models can be updated automatically, keeping production and quality smooth and consistent.

Pulp Tracking function accurately compensates for retention times
The built-in Pulp Tracking function effectively manages the grade changes or swings in pulp species throughout the washing line. It accepts various process and quality measurements upstream and tracks them through the various sections of the process such as blow tank, brown stock washing line, and oxygen reactors up to the unbleached HD tower. The tracked process variables are then used to develop non-linear empirical models of key quality variables such as pulp viscosity, which leads to tighter control of the delignification ratio. Pulp tracking accurately captures the process delays and retention times in the storage tanks and oxygen reactors, which are critical for tighter control of the post-oxygen-process Kappa number. It provides insights during swings in pulp quality and improves the process diagnostic capabilities. Pulp tracking also facilitates automated grade changes in the brown stock and oxygen delignification processes.

Operator displays and reports
Highly-intuitive, task-oriented and easy-to-access operator displays are provided to monitor real-time, historical and prediction trends data as well as modify tuning parameters. OPT800 Wash allows customization of the user interface to meet a wide range of project needs. The reports module calculates the key performance indicators such as chemical usage, controls utilization, and steam consumption, and presents them in the day/shift report. OPT800 Wash is delivered as a subscription-based service and consists of the state-of-the-art APC installation, start-up, and training, as well as tuning and monitoring services.