

Energy efficiency for the pulp and paper industry

Helping customers do more with less

Energy efficiency and the pulp and paper industry

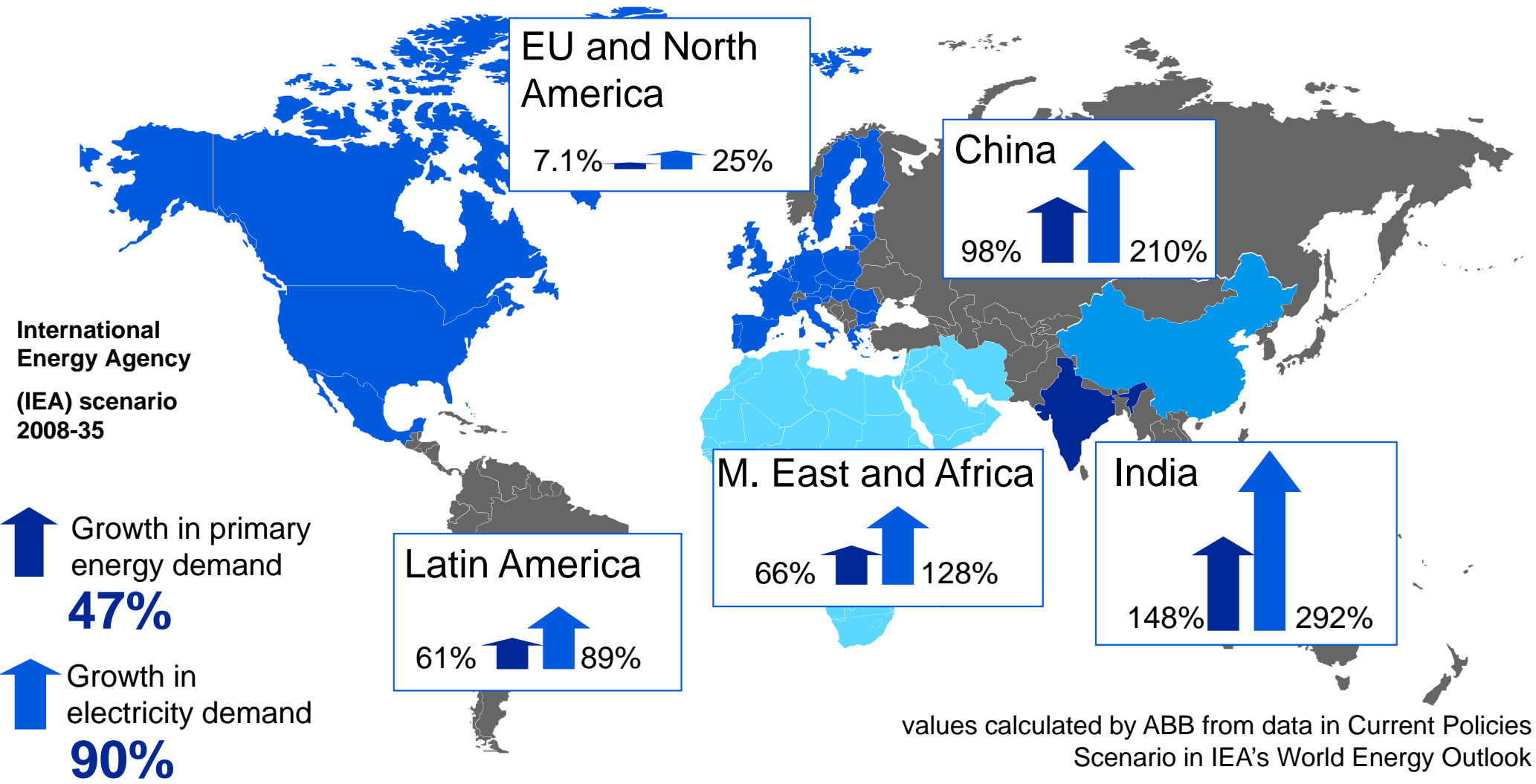
- Today's global energy challenge
- The case for energy efficiency
- ABB approach
- ABB solutions

What is energy efficiency?

- Doing more work with the same amount of energy
- Doing the same amount of work using less energy

World energy - - today's energy challenge

Rising demand



The link between growth, energy use and emissions

Meeting these challenges requires the world to:

Reduce the correlation
between economic growth
and energy use

Reduce the correlation
between energy use and
emissions

Energy
efficiency

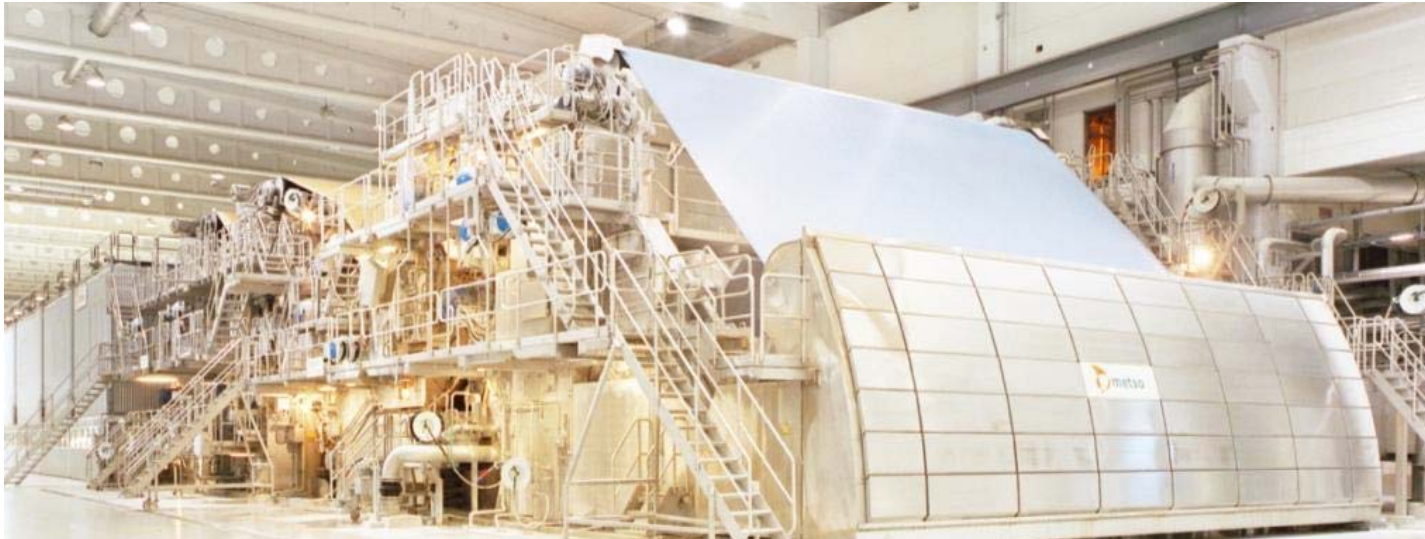
Renewable sources
of energy

Industry accounts for around one third of the world's final energy demand



- Industry's total energy use continues to grow as a result of expanding production volumes, a trend that is likely to continue in the coming decades as living standards rise in developing regions. Meanwhile, energy use by industry is in many parts of the world less than fully efficient, and in some parts of industry leaves much room for improvement.

The best way to avoid emissions is to use less energy in the first place



“On average, an additional dollar invested in more efficient electrical equipment, appliances and buildings avoids more than two dollars in investment in electricity supply.”

**International Energy Agency's
World Energy Outlook**

The case for energy efficiency in the pulp and paper industry



- The pulp and paper industry is highly competitive and is facing great challenges in the form of higher energy and raw material costs
- At the same time, the requirements for paper quality are high
- Maintaining profitability is directly tied to operational efficiencies including power use
- There are complex interdependencies between paper processes and energy use, and many benefits to optimizing them together
- Environmental performance is linked to corporate social responsibility and brand reputation

ABB's approach to energy efficiency

Doing more while lowering energy costs and emissions



Energy efficiency solutions

ABB uses its practical experience and technical expertise to identify opportunities where ABB equipment, solutions, software and services can improve efficiencies



Technologies

ABB is a global leader in power and automation technologies which are found in numerous pulp and paper applications

Though every mill is unique, all have areas where substantial energy savings can be realized while improving productivity, quality and reliability

The importance of energy efficiency for industry and utilities has never been greater but.....



- In a 2011 global survey*, almost 90% of manufacturers said that improvements in their energy efficiency will be a critical factor for business success in the next two decades
 - However, only 34% of respondents had done a company-wide energy audit and only 40% said they had made energy efficiency investments in the past three years.

**Trends in global energy efficiency,*
by the Economist
Intelligence Unit
and Enerdata

So why aren't manufacturers investing?

A lack of energy and process information



- Many plant operators do not have transparency into how much energy is being used and where
- Many industries do not have a baseline for energy efficiency, so its difficult to measure performance other than by monitoring the cost of electricity, which can be very volatile
- Despite the fact that process automation and plant electrification systems are increasingly interdependent, they are often separate islands of activity
 - In an ARC survey*, 42% of respondents said that automation was not represented on their energy management teams
- Other challenges include internal \$ competition, split incentives, and a lack of commercial finance products

**Trends in global energy efficiency, by the Economist Intelligence Unit and Enerdata*

ABB starts by helping customers discover energy efficiency savings opportunities through various services



- Many customers prefer to focus on a specific process area or issue
 - Motor-driven systems analysis
 - Power quality audits
 - Fingerprint services for specific process area
- There are those looking for a more comprehensive mill or site wide analysis that can be performed by ABB Consultancy Services
- And – others would like ABB to manage mill maintenance along with energy efficiency programs. For this, ABB Full Service® is the choice
- Once opportunities are harvested – solutions must be implemented to save money
- ABB's offers equipment, solutions, and software

ABB focus areas for energy savings opportunities

Power

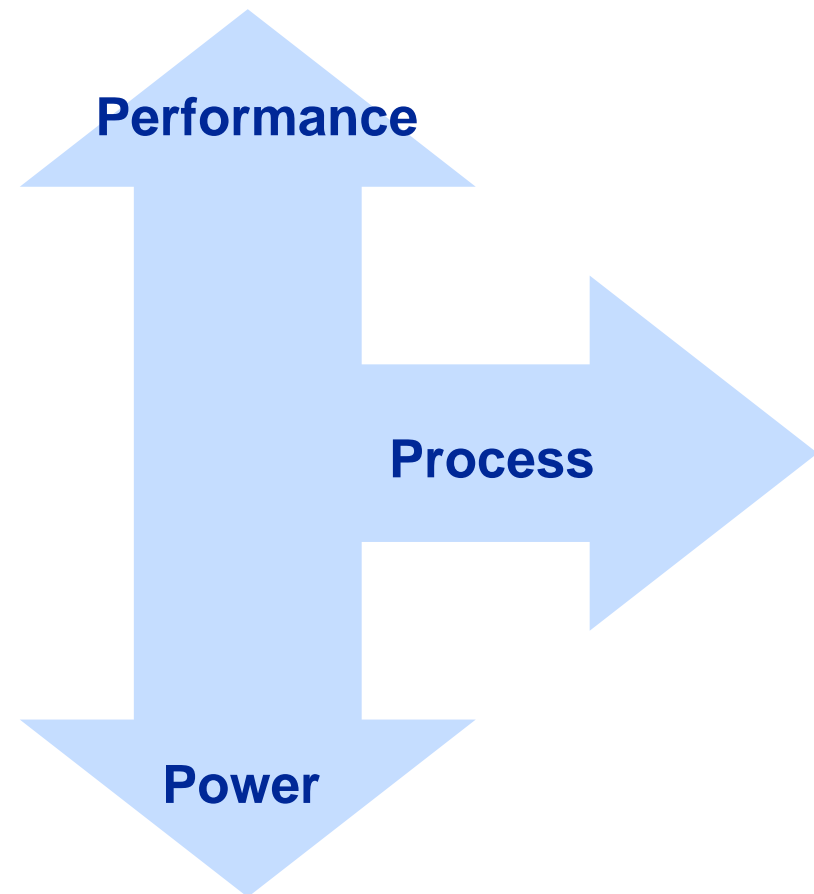
- Power distribution and process electrification
- Premium-efficiency motors
- Drives
- Transformers
- Power Quality

Process

- Automation
- Quality control systems

Performance

- Control solutions
- cpmPlus for Pulp & Paper
- cpmPlus Energy Manager



Energy efficiency begins with a well designed power distribution and electrification system

Power
Process

- Design mill electrification to optimize energy use

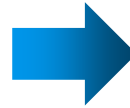
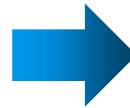


ABB designed power distribution and process electrification systems

Performance

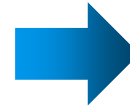
- Design and implement optimized pulp and paper mill electrification system



Electrification, Instrumentation and Composite Plant (EICP) service for new mill or mill expansion



- Implement more effective, efficient and stable electrical distribution systems



Power Management Systems (PMS)

- Enable energy efficiency solutions



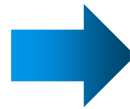
Measurement products, emergency power supply / UPS, gas insulated switchgear, substations

Increase motor-driven system energy efficiency while improving reliability and availability

Power
Process
Performance

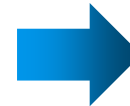


- Increase motor-driven systems' energy efficiency while improving reliability, availability, and system power factor
- Replace motor-system mechanical speed control to reduce energy use, improve productivity and paper quality
- Reduce maintenance and save space while saving energy



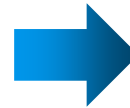
Premium-efficiency motors

Low-voltage switchgear technology with MNS iS motor management

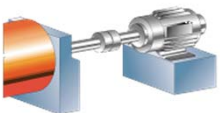
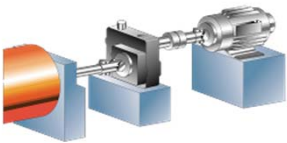


Variable speed drives

Paper machine drives / PMC800 drive control system



Direct-drive paper machine solution with permanent magnet motor



Energy efficiency components make a difference

Power

Process

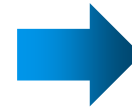
Performance



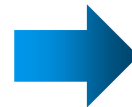
- Reduce energy costs associated with drive room air conditioning
- Lower total cost of ownership and improve efficiency (large load or low load losses)
- Improve reactive power compensation and power factor correction



ACS800 liquid-cooled drives for paper machines



Low-loss “green” distribution transformers



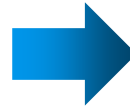
Site assessment services and solutions such as active filters and capacitors for power quality improvements



Optimize complex operations for energy efficiency, product quality, waste reduction and profitability

Power
Process
Performance

- Improve sub-optimized processes and reduce waste with automation



- 800xA Extended Automation for paper making
- Control Room- reduce energy use by integration of process knowledge
- Boiler Control – improve reduction and thermal efficiency



Measurement and control system precision minimize energy use

Power
Process
Performance

- Optimize energy savings through optimum paper machine performance and control

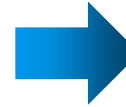


ABB Quality Control Systems (QCS)

- Actuators, sensors and other enabling instrumentation
- SteamPlus – reduces steambox steam use
- Fiber Orientation Sensor - orientation measurement and control to reduce fiber requirements and decrease steam usage

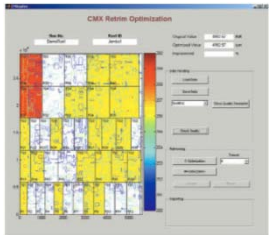
Optimized control tools and software link inter-related functions to assure energy savings

Power
Process
Performance

- Link mill inter-related functions to assure efficiency, reliability and energy savings



- Optimize business processes and flexibility of production management



- Understand how and where you use energy. Provide energy use decision support



➔ ABB comprehensive set of control solutions for continuous and batch digesting, pulp washing, bleaching, re-causticizing and recovery boilers

➔ cpmPlus for Pulp and Paper

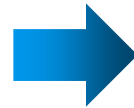
- Production Planning & Management
- Pulp Production Planning
- ABB Quality Re-trim to optimize trim patterns to minimize waste

➔ cpmPlus Energy Manager

ABB offers related solutions for pulp and paper operations



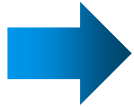
- Meter electricity use for input to energy management systems



DIN-mounted electricity meters



- Enable energy savings through pulp and paper industry-specific instrumentation

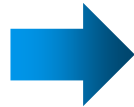


Lorentzen and Wettre products

KPM products



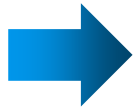
- Enable energy savings through instrumentation



General measurement products / instrumentation



- Improve energy efficiency of buildings and facilities



i-Bus® KNX building automation systems for monitoring and control of lighting, HVAC, etc.



Evaluate mill operations to identify energy performance improvement opportunities

Power
Process

Performance


- Identify and document opportunities for performance improvements for a specific process area

 Fingerprint services

- Manage and assume responsibility for entire mill maintenance including energy use performance improvements

 ABB Full Service ®

- Implement measurable and manageable energy improvement programs

 ABB Energy Solutions
Industrial Energy Efficiency
assessments and services

Motor-system assessments

Power quality audits



ABB can Power your most demanding processes while using energy more efficiently.



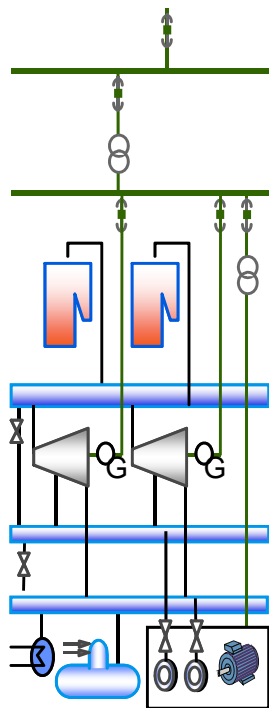
- From the design phase to keeping an older mill profitable and productive . . . ABB's experts can help design and integrate your power distribution, process electrification and process automation systems to unlock the highest levels of productivity and energy efficiency.
 - ABB's systems ensure stable, reliable power across your networks and protect you from the costs and lost productivity of poor power quality
 - We have a wide range of products that enable and improve energy efficiency and reduce losses, from your distribution network to your most energy intensive processes

Energy efficiency begins with a well designed power distribution and process electrification system

Power

Process

Performance



- ABB's extensive experience in pulp and paper electrification projects worldwide guarantees maximum value during the entire life of the mill
- ABB offers complete power distribution and process electrification solutions
- Energy efficiency is a crucial factor when extending or improving an existing system or a new line. System design and energy efficient components make a difference, while ABB products and systems optimize energy use
- ABB can design, dimension and optimize your network to save energy while improving power reliability, quality and safety. Considerations include:
 - Voltage levels, network topology
 - Transformer optimization
 - Harmonics and compensation
 - Measuring and control
 - Availability solutions
 - Safety and protection

EICP

Electrification, Instrumentation and Composite Plant

Power

Process

Performance



Unified automation integrated with power distribution, process electrification and instrumentation

- ABB will design and implement an optimized electrification solution for a new mill or mill extension for the entire life of the pulp or paper mill
- ABB can provide engineering, procurement, installation and commissioning services for the electrification, power distribution, automation and instrumentation for pulp and paper mills
- By acting as the single source from the initial design to full production ABB can
 - Reduce the project duration
 - Control project cost
 - Provide preliminary tender offers with limited process specifications
 - Ensure a smooth start up on time

ABB Power Management Systems (PMS)

More effective, efficient electrical distribution systems

Power

Process

Performance



- Intelligence of industrial electrical networks is increasing rapidly
- With more information available from the process itself and the supplying energy networks, process operation is likely to be more energy efficient
- Emergency Load Shedding (ELS) – When external power supply is suddenly lost, entire mill power system is changed to island mode operation and mill continues operating independently, which minimizes disturbances and value of lost production
- Peak load control / peak shaving – keeps power consumption to agreed peak value to avoid penalties from utility company
- Reactive power control (RPC) – improves energy efficiency by reducing reactive power flows in distribution system. Expensive sanctions applied by Utilities if agreed reactive power limits are not followed
- ABB PMS application with ABB AC800M controllers and HMI - achieve and maintain stable mill operation (frequency and voltage)

Energy efficient components make a difference

Premium-efficiency motors

Power

Process

Performance



High efficiency not only lowers costs but reduces CO₂ and greenhouse gas emissions

- Energy costs to run a motor equate to ~90 percent of the long-term cost of ownership - - energy efficiency improvements offer major savings in energy costs
- Energy use can be reduced through using more efficient motors along with efficient speed control
- Premium-efficiency motors offer
 - Increased energy savings and uptime
 - Superior reliability and availability and longer life
- More than just hardware
 - Dimensioning the motor affects cost and reliability
 - Adjusting reactive power and filtering harmonics impacts mill costs
- ABB offers low-voltage switchgear technology and motor control system called MNS iS for improved power factor. MNS iS not only reduces the losses of an individual motor but optimized operation of a whole set of mill motors

Drives – replace mechanical speed control with variable speed drives to reduce energy use

Power

- Use of variable speed drives can cut energy costs by up to 60 percent

Process

- Pumps or fans running at half speed consume one quarter of the energy as a unit running at full speed with a mechanical throttle for control

Performance

- ABB is a market leader in drive systems for the pulp and paper industry – improved availability and efficiency are our objectives
- The PMC800 drive control system operates smoothly with the drives and motors found in any pulp and paper applications. ABB solutions:
 - Engineered AC or DC drives
 - Drive control system
 - Direct drive (no gear box) solution
 - Water cooled drives
 - Drive system rebuilds for ABB drives and most third-party DC drives
 - Drives Systems Expert Services and remote services



The drive control software can significantly impact overall energy efficiency

Paper machine drives

Energy and maintenance savings

Power

Process

Performance

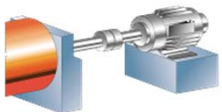
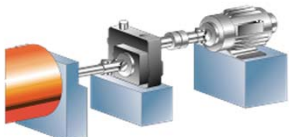


- ABB AC and Direct Drive energy efficient paper machine solutions offer fast start-up and operational lifecycle benefits

- Increased productivity
- Improved paper quality
- Energy savings

- ABB Direct Drive / permanent magnet motor solution for paper machines offers an energy efficient solution

- The motor is directly coupled to the paper machine
- For highest energy efficiency, ABB provides permanent magnet Direct Drive motors that offer initial investment savings and on-going energy savings



Direct Drive / permanent magnet motor drive solution

Reduced energy losses

Power

Process

Performance



- ABB Direct Drive solution for paper machines
 - Gear box is eliminated including the high energy losses typically associated with a gear box
 - No gear box means reduced mechanical components resulting in lower maintenance
 - Very high horse power in low voltage
 - Direct Torque Control (DTC) – high torque at low speed
 - No tachometers required
 - Synchronous drive offers accurate speed control for better paper machine operation
 - Saves floor space
 - Lower energy costs due to lower overall losses (no gear losses, higher efficiency motor)

Paper machine drives

Liquid cooled reduces air conditioning requirements

Power

Process

Performance



98% of heat losses carried out in liquid

- ABB ACS800 liquid-cooled drives
 - More efficient cooling than air. Eliminate heat loading to room. No air conditioner required
 - Compact drive cabinets - reduced cabinet line up by 50% and therefore reduce cost for drives room
 - Completely enclosed
 - Silent operation
 - Designed for harsh environments

Environmentally sensitive low-loss distribution transformers – considerable opportunities for savings

Power

Process

Performance



Green-R-Trafo™

*European Commission Directive 2009/125/EC, Sets Ecodesign transformer efficiency requirements. Load & no load loss standards for small to medium power, and energy efficiency requirements for large power transformers

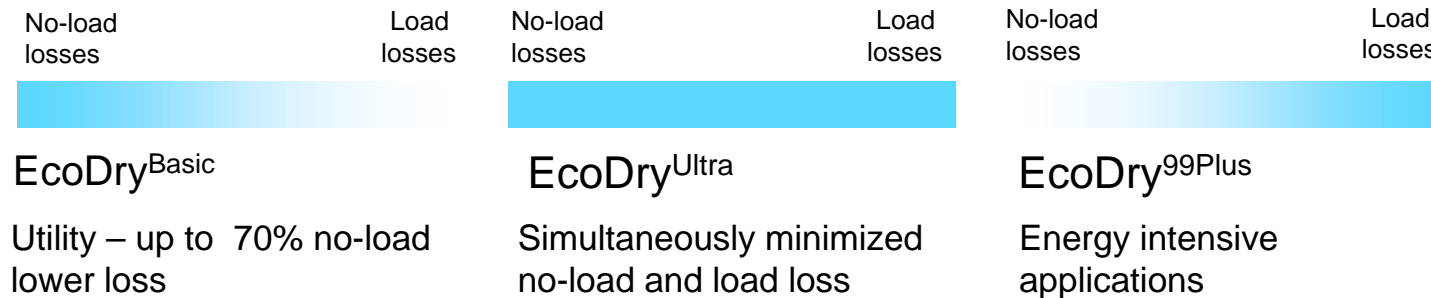
- ABB delivers a complete portfolio of transformers designed to grant the reliability, durability, and efficiency required in utility, industrial, and commercial applications
- ABB offers highly efficient low-loss liquid-filled and dry-type transformers to meet increasing government regulatory requirements*
- Green-R-Trafo™ platform is based on an Amorphous metal core with Biotemp® and other biodegradable fluids for environmental friendliness. Compared to conventional e-steel transformers these offer:
 - 40 -70% lower no-load losses for greater efficiency
 - Higher fire point, longer life and biodegradable insulation
 - Continuous energy savings = reduced CO2 footprint
 - Payback in as little as 3 years

EcoDry

The highest-efficiency dry-type transformers

Power
Process
Performance

- ABB is a unique manufacturer with more than 35 years of experience with dry-type technologies:
- ABB offers a family of EcoDry transformers – the highest-efficiency dry-type transformers
- EcoDry^{99Plus} is designed for large average loads
- EcoDryUltra – applications with constant load and redundant supply from 2 transformers (pumping or ventilation), or strongly varying loads like renewable energy (wind, photovoltaic)
- EcoDry^{BASIC} – utilities reduction of no-load loss has major impact as average loading relatively low



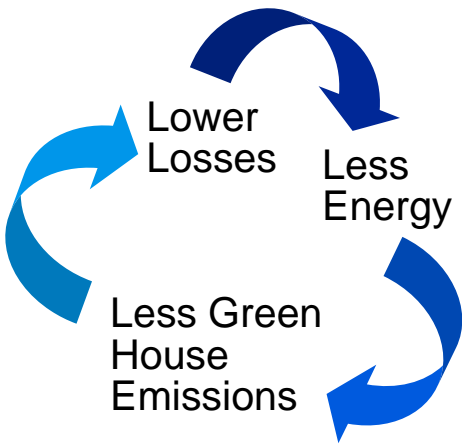
Transformers

Not a commodity

Power

Process

Performance



*Best practices manual, Transformers, Bureau of Energy Efficiency (under Ministry of Power, Government of India), 2006

- Distribution transformers offer considerable potential for energy savings. Paying attention to loss evaluation can save money, energy and CO2 emissions during the life of a transformer
- ABB customizes transformer solutions to meet your technical and financial requirements
- ABB can design transformers to reduce no-load losses, load losses or both
- A trade off or balance between high efficiency (higher initial cost) and lifecycle cost savings (loss evaluation) is required when improving transformer efficiency. The lifecycle costs of low-loss distribution transformers (for 15 years) are around 30% lower than traditional transformers*
- ABB recommends you consider the total cost of ownership when developing your transformer strategy
 - Continuous energy savings starting with installation
 - Less heat generation due to lower losses – increased transformer insulation life

Power quality solutions to improve energy efficiency

Power

Process

Performance



- Meeting production demands and network power quality regulations are impacted by
 - Harmonic pollution, reactive power and load unbalance which result in
 - Energy inefficiencies and losses
 - Equipment damage or failure
 - Lost production
- ABB's comprehensive range of solutions for LV networks includes:
 - Active filters that resolve power quality problems caused by harmonics, load unbalance and reactive power demand for industrial and commercial installations
 - Power factor correction capacitors (fixed and automatic)
 - FACTS SVC (Static Var Compensator) and STATCOM (SVC Light®) for high speed, dynamic voltage control to maintain constant voltage at the load point, increase transmission capability and stability and maintain grid power quality
 - Surge arresters

Process: ABB's extensive pulp & paper experience can help integrate energy efficiency into your operations



- Our experts can help you optimize the most complex applications in ways which increase productivity and quality while improving electric and thermal energy efficiency
- Reducing the time to decision and action is critical to reducing energy waste. ABB's System 800xA provides increased visibility and faster reactions to changing production and power demands in real time
- In addition ABB can optimize the performance and energy efficiency of your paper machine through advanced process and quality control systems
- By unifying controls and operator interfaces under a common architecture, we can help you create a collaborative environment for energy efficiency

Optimize complex operations for energy efficiency, product quality, waste reduction and profitability

Power

Process

Performance



Connect
enterprise
and mill
systems,
applications
and devices

- Reducing time to decision and action is key to reducing fuel, steam and electricity waste in a mill
- ABB helps customers improve sub-optimized processes and reduce costs with its automation offering, Extended Automation System 800xA
 - Reduces the time to decision and action
 - Engineered for maximum performance
 - Integrates information for improved visibility and advanced control
 - Optimizes mill asset availability and performance
- Automation systems are unified under a common architecture and user interface providing a collaborative environment for real-time decision making
 - Lower cost of ownership
 - Increased reliability
 - Improved operator efficiency

Improve sub-optimized processes by implementing visibility and advanced control

Power
Process
Performance



- **Control Room** – ABB's 800xA Control System allows staff to adjust processes to run at optimal level
 - Reduction in energy use and in raw material use
 - Processes run uninterrupted
 - Energy use can be reduced by 10 percent when operator uses integration of process knowledge with System 800xA at full capability
- **Boiler Control** – ABB Recovery Boiler controls optimize burning process and soot blowing
 - Maximize burning capacity
 - Improve reduction and thermal efficiency
 - Decrease soot blowing steam use and gaseous emissions

Energy savings through optimum paper machine performance and control

- Power
- Process**
- Performance
- The paper machine is the most expensive part of the process in terms of energy
 - **ABB Quality Control Systems (QCS)** – good control starts with good measurement
 - ABB on-line measurement and control systems provide the ability to precisely measure the characteristics of paper while being produced – thereby systems can make adjustments to minimize energy use
 - ABB actuators and sensor can reduce total paper machine steam usage by 10% by applying highly-focused energy to the precise spots in the process

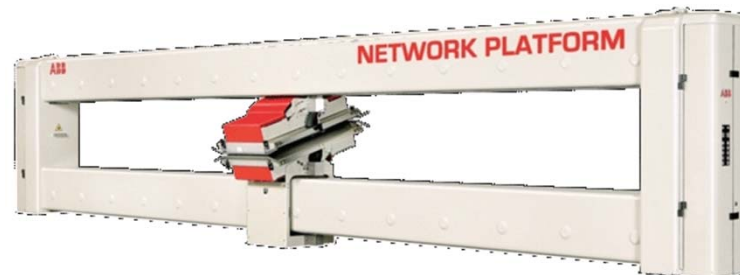


ABB Quality Control Systems enable adjustments through measurement of paper characteristics

Power

Process

Performance

- **SteamPlus Profiler** energy savings opportunities from
 - Reduced Steambox steam consumption
 - Reduced Dryer steam load



- **Fiber Orientation Sensor** – distribution of wood fiber in a sheet of paper is critical to ultimate end purpose of the sheet. Measurement and control of the angle and orientation of the fibers provides the ability to reduce fiber required and steam usage while increasing yields and quality.

- On line control of fiber ratio and angle
- Optimizing strength
- Reducing rejects

Fine Printing



Newsprint & Packaging

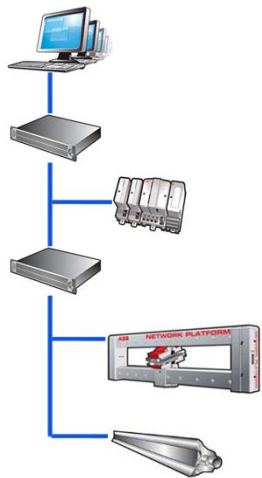


ABB can unlock the full Performance potential of your mill while helping you do more with less energy



- ABB can help you make use of the information already in your automation system to predict and control operations. This allows you to manage raw materials and run at the highest level of efficiency.
- We can link interrelated mill functions such as production planning, scheduling and trimming to collaboratively optimize reliability, productivity and energy efficiency.
- ABB's cpmPlus Energy Manager can help you understand where and how you use energy. It can provide energy use decision support, help you accurately predict energy demand based on production plans, and even account for external factors such as spot energy prices.

Optimized control solutions and software to improve productivity and energy efficiency in related practices

Power

Process

Performance.



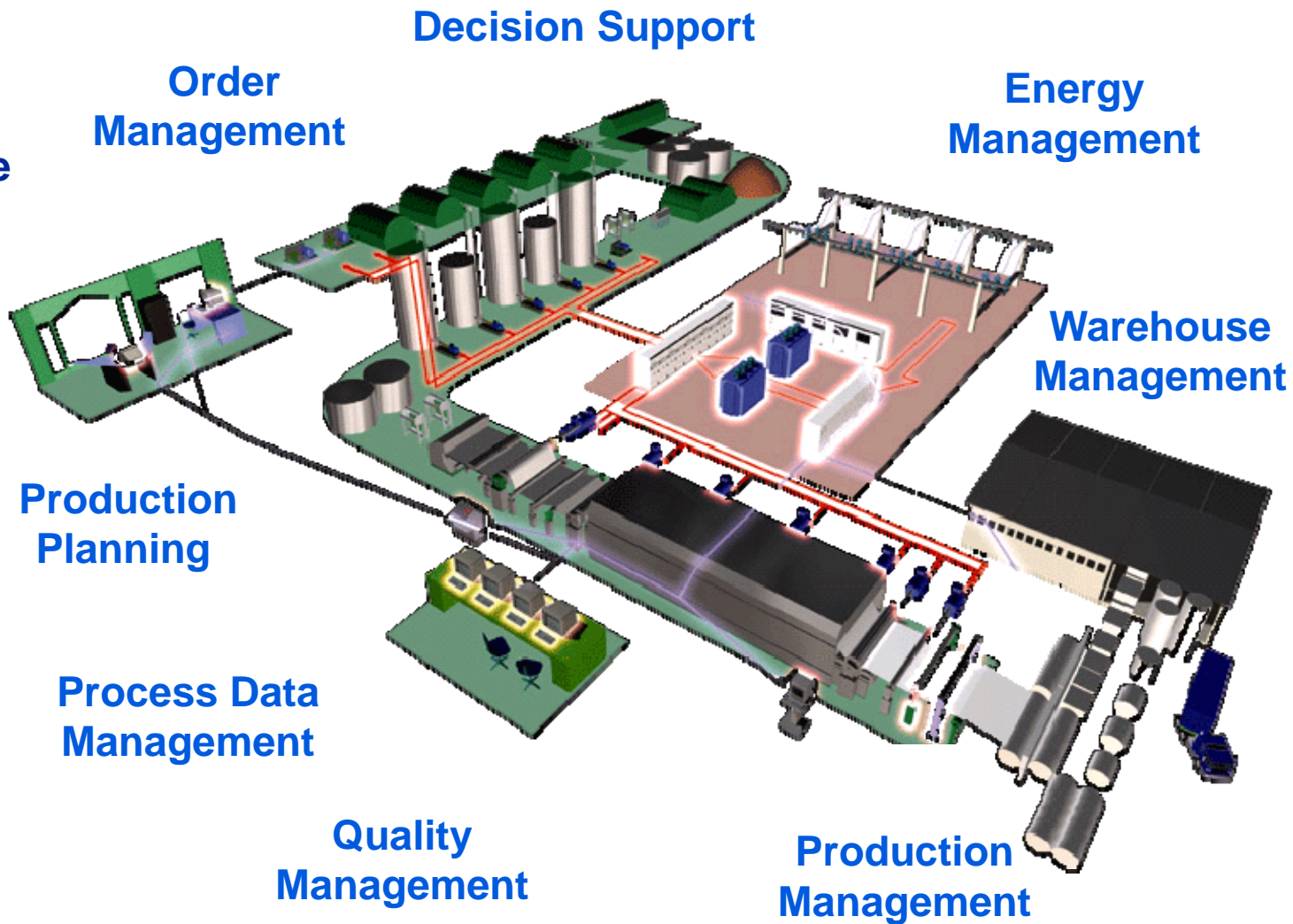
- ABB's advanced solutions can improve mill management by linking mill automation, optimization and collaborative business practices. This allows you to make use of the information already in your automation system to predict and control operations, manage raw materials and run at highest level of efficiency.

ABB Optimized Control Products - - ABB offers a comprehensive set of Advanced Process Control products (APC) for the whole pulping process consists of continuous and batch digesting; pulp washing, bleaching, re-causticizing; and for recovery boilers. Example benefits:

- Optimized Chemical charge reduces the effluent load and average temperatures thus decreasing steam usage in bleaching
- Reduced evaporation cost and Increased washing efficiency by optimizing dilution factor control in Washing
- Decreased use of steam in digesters by cooking cycle optimization
- Decreased steam consumed in evaporation process by decreasing the white liquor circulation
- Optimized lime kiln temperature profile for minimum energy requirements.
- Reduced Energy requirements in Recovery boiler by reducing excess Oxygen combustion controls and optimized soot blowing strategy based on heat transfer coefficient.

Collaborative Production Management (cpm) software – operational excellence through optimized business process and flexible production management

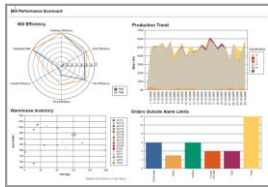
Power
Process
Performance



cpmPlus for Pulp and Paper

Better production management for decreased costs

Power
Process
Performance



- Order Management
- Production Scheduling & Trim Optimization
- Production Management
- Quality Management
- Decision Support advanced reporting

- ABB cpmPlus for Pulp and Paper decreases costs through better production scheduling and management, and increases revenues through improved customer service and product quality resulting in increased profits
 - Optimized material and energy use
 - Accurate, immediate visibility
 - Improved capacity utilization
 - Minimized production losses – cost of trim waste, grade changes
 - Reduced inventories including warehousing costs
 - Optimized product delivery – no order delays
 - Optimized quality
 - Advanced control
- Optimize processes via cpmPlus – capitalize on best practices through ABB products and expert support

cpmPlus for Pulp & Paper production planning and optimization

Enterprise-wide plans for efficient operation

Power

- **cpmPlus Production Planning and Management**

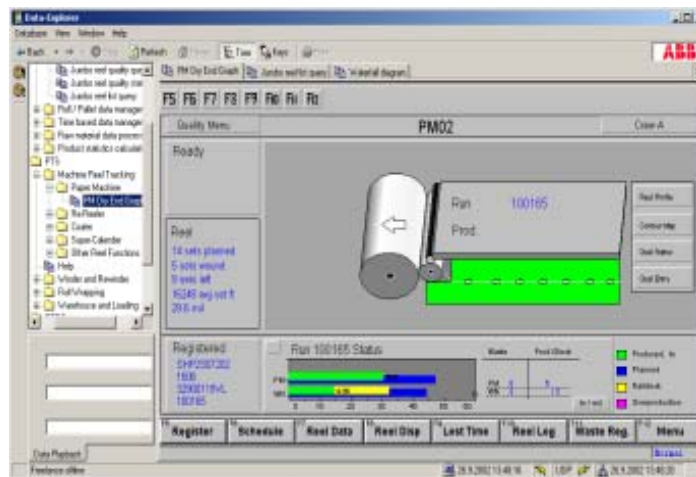
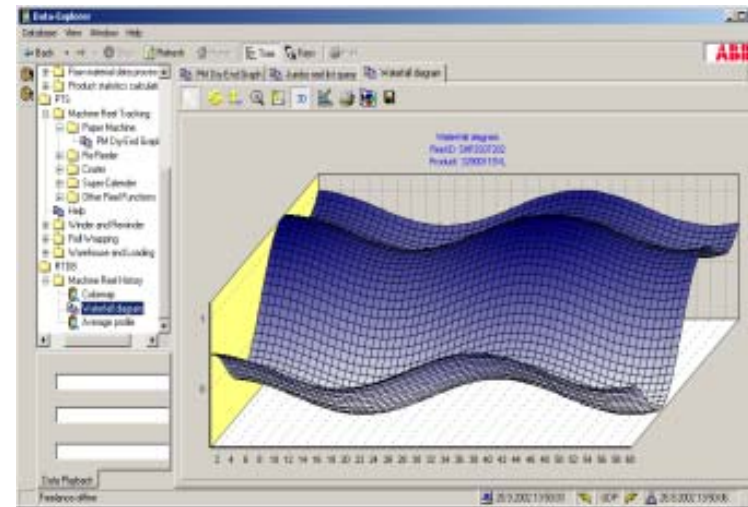
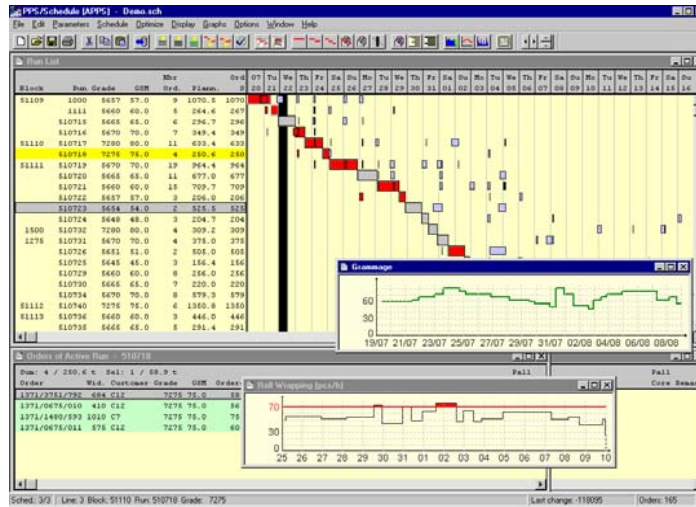
Process

Performance

- Planning production across the entire enterprise is critical to efficient operation – all manufacturing, warehouse, loading and delivery operations; materials (pulp, chemicals, packaging), product recipes and consumption for costing
 - Plans can be created for multi-machine or multi-mill environments
 - Optimize mill and machine capacity, minimize inventory, ensure on-time delivery
 - Machine efficiency maximized, predict bottle necks and overload situations
- **Pulp Production Planning**
 - Integrates paper and board production planning with energy management providing real-time forecasts for pulp, water, chemical and energy balances

cpmPlus for Pulp & Paper production planning and optimization

Enterprise-wide plans for efficient operation



cpmPlus for Pulp and Paper Quality Re-trim

Reduced waste from 8 percent to over 25 percent

Power

Process

Performance



ABB Quality Re-trim

- Reducing waste means reduced energy use - - ABB Quality Re-trim has:
 - Reduced waste from 8 percent to over 25 percent In seconds on the machine floor
- Product plans are affected by the realities of the manufacturing process
 - Off quality production can lead to significant trim losses
 - Fiber can be recovered - - energy can not
- During papermaking, quality data is collected and used to optimize trim patterns to minimize waste and off-spec rolls

cpmPlus Pulp and Paper Solutions with comprehensive functionality 1/2

Power
Process
Performance

- **cpmPlus Order Management** – agility through full integration, single form for all order entry functions, invoicing
- **cpmPlus Production Planning – Scheduling**
 - Minimize delays, deviations from ordered quantities, grade change costs, trim losses and inventories
- **cpmPlus Production Planning – Trimming**
 - Flexible trim adjustment, minimize trim loss - trim scheduling, trim optimization using trimming scenarios
 - Re-trimming – flexible trim adjustment, minimize loss
 - Quality based trimming (Q-trim) – maximize value of production



cpmPlus Pulp and Paper Solutions with comprehensive functionality 2/2

Power ▪ **cpmPlus Production Management**

Process ▪ Better production and delivery control.

Performance ▪ Reduces inventories (FG, WIP, materials)



▪ **cpmPlus Quality Management** – comprehensive quality control, minimum quality losses, decreased reclamation costs, visualize and consolidate quality related data from multiple sources



▪ **cpmPlus Decision Support** – transparent and flexible reporting




cpmPlus Energy Manager software

Start by knowing where and how much energy is used

Power
Process
Performance



ABB offers a complete range of DIN-mounted electricity meters with a wide range of communications options 

- cpmPlus Energy Manager is a decision support tool to
 - Reduce energy costs
 - Improve energy efficiency
 - Manage carbon footprint

The software solution allows you to:

- Monitor and report energy usage and efficiency against targets
- Accurately predict energy demand based on production data
- Balance energy usage against purchased energy commitment
- Optimize energy usage, production and procurement
- Support decision making with “what-if” analyses
- Typical customer can achieve cost reduction of **2 – 5%** of total energy costs
- Scalable – start with basic energy monitoring and reporting for a single site - - scale to multiple sites
- Help meet the new ISO50001 global energy management framework by incorporating energy management into daily practices

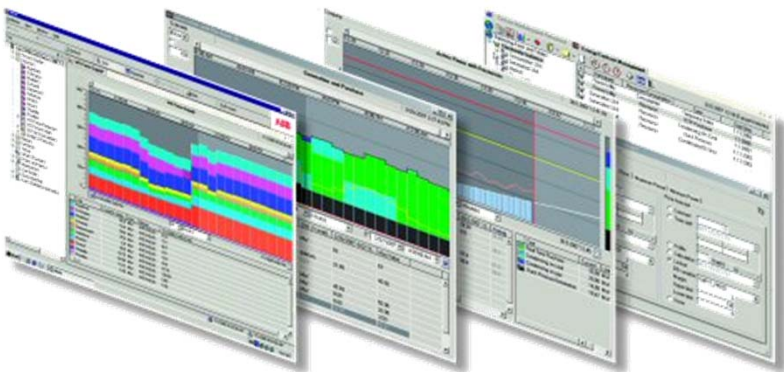
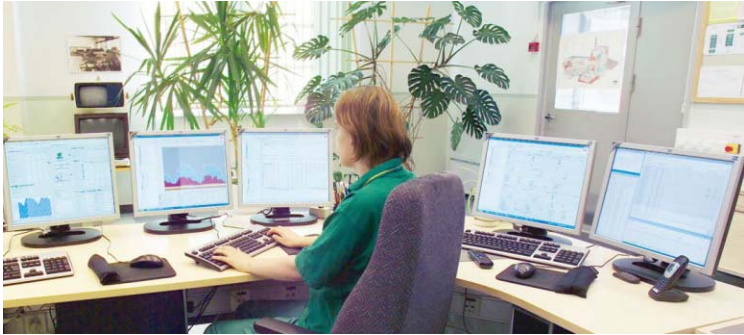
Energy management software economic objectives

Balance energy requirements against supply

Power

Process

Performance



- Scalable – start with basic energy monitoring and reporting for a single site - - scale to multiple sites
- Know your energy needs
 - Sophisticated planning tools
 - Forecasting electricity and steam demand
 - Planning energy use
- Meet your energy needs
 - Resource optimization
 - Production scheduling (pulp production and paper production)
- Support for energy sales and purchase
 - Timing and pricing of transactions
 - Avoiding peak tariffs
 - Load planning, tie-line monitoring and load shedding

Electricity meters identify energy use

One step closer to reducing energy use



- ABB offers a complete range of DIN-mounted electricity meters with a wide range of communications options
 - Compact design
 - Easy to install due to DIN-rail mounting
 - Standard pulse / LED output or infrared (IR) port that can be connected to any of the Serial Communication Adapters (SCA)
 - In-house certified laboratory (SS-EN/ISO/IEC 17025)
 - Approved according to international & national standards
- There are four one- and three-phase product lines in several configurations for different applications

Energy efficiency enabling solutions For pulp and paper operations



Pulp and Paper industry-specific instrumentation energy efficiency enablers

- Lorentzen & Wettre
 - Laboratory products - Pulp and paper properties
 - Paper optimization products
- KPM products
 - Full range of consistency transmitters, sheet break detectors and pulp samplers
 - All technologies available – microwave, rotary, blade and optical
 - Paper optimization products

Energy efficiency enabling and related solutions For pulp and paper operations



General Measurement Products / Instrumentation – energy efficiency enablers

- Boilers, lime kiln calcination – on-line combustion gas analysis for air-to-fuel ration control. Improved efficiency.
- Boilers - Universal and Linear Pneumatic Rotary Actuators for induced draft fan damper control for air-to-fuel ration control, energy efficiency improvements.
- Web tension measurement products for paper machine wet end and dry end (dryers, calenders, coaters & winders) (Pressductor® PillowBlock Load Cell and Preactor® Radial Load Cell Systems)
- Mill air – Control Valve Positioner – reduce air usage for energy savings
- Steam mass flow measurement - Flowmeters – pinpoint leaks, faulty steam traps, reduce waste. Also steam quality measurement products



Buildings

- i-Bus® KNX systems – automation system for monitoring and control of lighting, HVAC, shades, etc. (not available in the Americas)

ABB can help enable energy efficiency savings

Our service options are tailored to your requirements



- **ABB Fingerprint Services** identifies, documents and provides an implementation plan for specific process area opportunities such as boilers and paper machine tissue machines to super calendering
- **ABB Full Service®** will partner with you to improve then maintain energy efficiency
- **Motor-Driven System Assessments** help customers identify where energy can be reduced using variable speed drives or high-efficiency motors
- **ABB Energy Solutions team** can assess, implement and provide financing options for the entire mill or a specific area
- **Power Quality** improvements through site harmonic evaluations and energy audits to assess power quality issues and recommend remedies

Fingerprint Services

Specific process area performance opportunities



Fingerprint Services

- Paper Machine
- Pulp Dryer
- Profile Grade Performance
- Color
- Off Machine Coater
- Stock Approach
- Supercalender
- Batch Digester
- Boiler

- Identifies and documents opportunities for performance improvements in a specific process area
- Fingerprint used to compare performance in the future
- Implementation plan provides detailed ROI based solution designed to improve efficiency, quality and production
- Benefits include
 - Energy savings and reduce carbon footprint
 - Increased product quality and capacity
 - More responsive to process energy demands
 - Extended operating range
 - Higher reliability, improved safety
- Historically ABB has uncovered potential savings in excess of 10 times the cost of the service

ABB Full Service®

ABB partners to manage mill maintenance activities



ABB Full
Service®

- Partner with ABB to identify, project manage and finance energy efficiency opportunities
- ABB takes responsibility for the engineering, planning, execution, and management of an entire mill's maintenance activities
- ABB Full Service Agreements - - ABB will
 - Benchmark your mill and identify energy cost saving projects
 - Supply on-site engineers, supervisors and technicians to provide change management, front-end engineering, installation and commissioning
- As an alternative to paying for individual projects, we can offer you an ABB Full Service Agreement where you pay ABB based on the saving created, which allows you to share in the results.

Motor-driven system assessments and power quality evaluations



Motor-driven systems

- Energy usage accounts for 92% of motor costs & should be a priority for motor life-cycle costs
 - Electric motors driving machines, compressors, fans, pumps or conveyors equal about two-thirds of the industrial electricity usage
- ABB energy efficiency motor / drive assessments help customers identify where energy usage can be reduced - - thereby saving money and environmental impact
- ABB also provides useful energy savings calculation tools such as PumpSave and FanSave to compare traditional flow control methods to variable speed drive control. Tools available on ABB web site



Power quality

- ABB site harmonic evaluation and energy efficiency audits help customers assess power quality issues and identify remedies

Industrial Energy Efficiency savings programs

Accelerate the cost savings



ABB Energy
Solutions

- ABB Energy Solutions team is prepared to start the journey based on customer priorities
 - Energy assessment required to identify energy use and efficiency improvements opportunities
 - Project or focus area identified - need help with implementation or financing options
- An energy assessment can only benefit profitability if the savings opportunities are implemented
- Delivering sustainable energy efficiency requires a broad range of skills. ABB's team includes
 - Energy and functional engineering specialists
 - Change management practitioners
 - Project managers, estimators and planners
- The goal is to deliver a manageable number of projects that will deliver between 5% and 20% in energy savings

ABB helps remove barriers to energy savings implementation (Europe)



ABB Energy Solutions

- ABB understands that energy audits often do not turn into real savings due to
 - Risk aversion to non-core technology
 - Lack of capital
- ABB programs address these barriers

Barrier	Program	Details
<ul style="list-style-type: none">▪ Risk aversion to non-core technology	<ul style="list-style-type: none">✓ Guaranteed savings program	<ul style="list-style-type: none">▪ Standard purchase order▪ ABB guarantees payback
<ul style="list-style-type: none">▪ Lack of capital	<ul style="list-style-type: none">✓ Shared savings model	<ul style="list-style-type: none">▪ Energy performance contract▪ Financing offered, energy savings shared
<ul style="list-style-type: none">▪ Energy savings opportunities need to be identified	<ul style="list-style-type: none">✓ Standard assessment	<ul style="list-style-type: none">▪ ABB conducts mill assessment of energy reduction opportunities

Other ABB services offerings

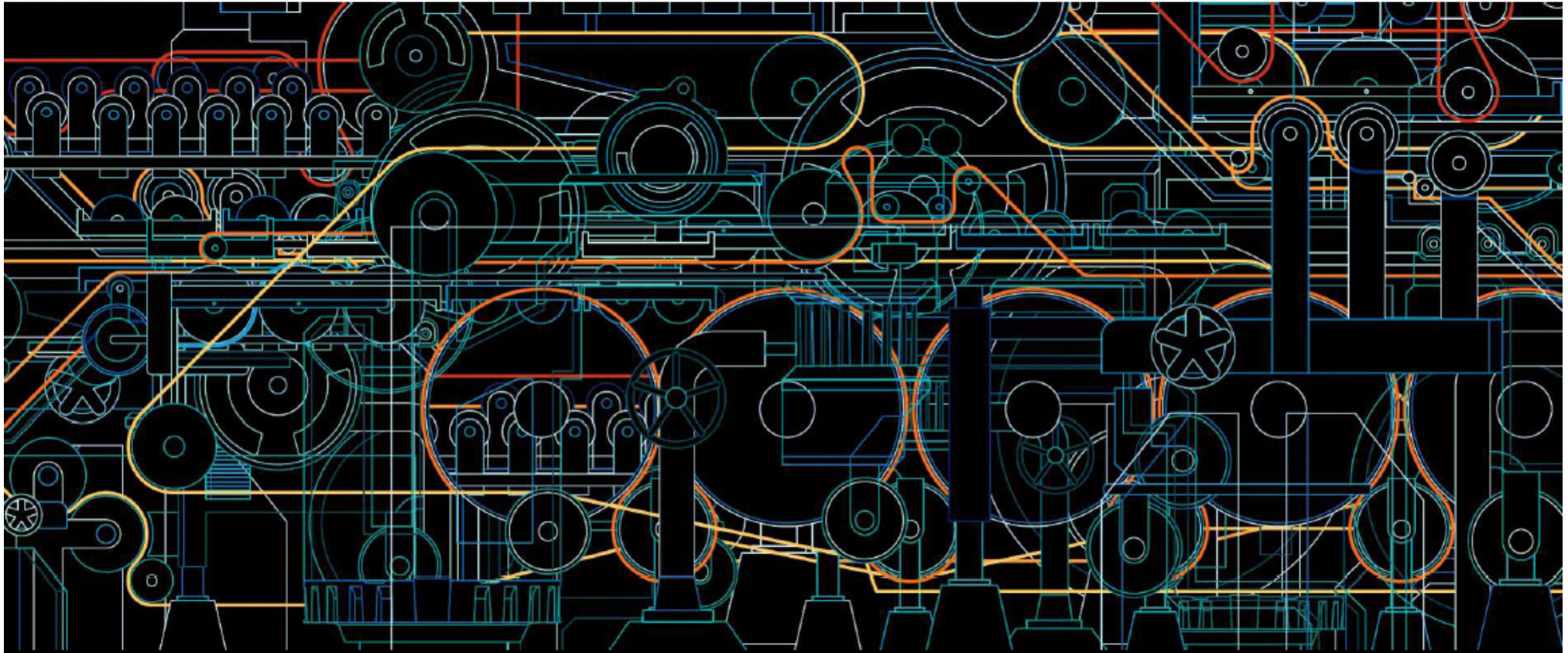
Power
Process

- Providing world class support to ensure maximum performance for ABB systems and products.

Performance

- Diagnosis / optimization
- Engineering and consulting
- Maintenance and field services
- Repair
- Spare Parts
- Training and skills development
- Environmental services
- Migration and upgrades
- Retrofit
- Support and remote services

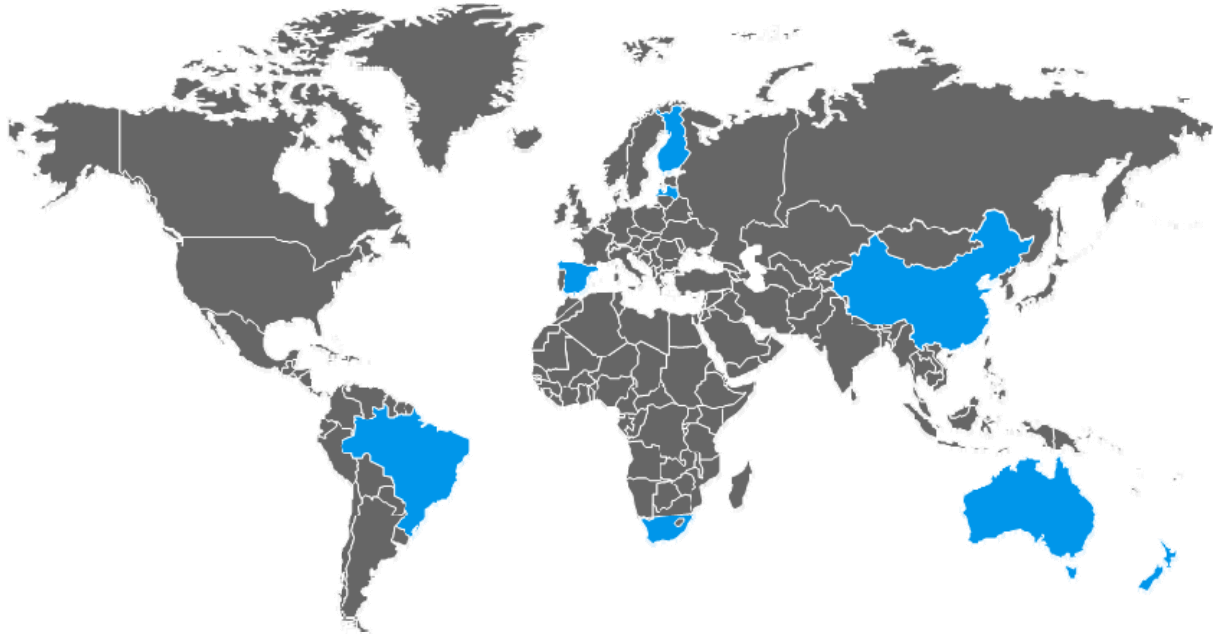




Appendix

ABB Full Service®

Found at the world's leading pulp & paper mills



- Amcor Packaging – Botany, Australia
- April Rizhao, China
- Arcel Aracruz Cellulose SA- Brazil
- Carter Holt Harvey (CHH) – Kinleith, New Zealand
- Corenso United LTD Oy, Finland
- Georgia Pacific, Finland
- Huhtamäki, Finland
- Klabin Papéis, Brazil
- Myllykoski Paper Oy, Finland
- Papelera de Brandia, Spain
- Sappi Cape Kraft, South Africa
- Stora Enso Packaging (2), Finland
- Stora Enso Packaging, Latvia
- Stora Enso (Efora), Finland
 - Heinola Mill
 - Imatra Mill
 - Oulu Mill
 - Uimaharju Mill
 - Varkaus Mill
 - Veitsiluoto Mill

Energy Efficiency begins with a well designed power distribution and electrification system

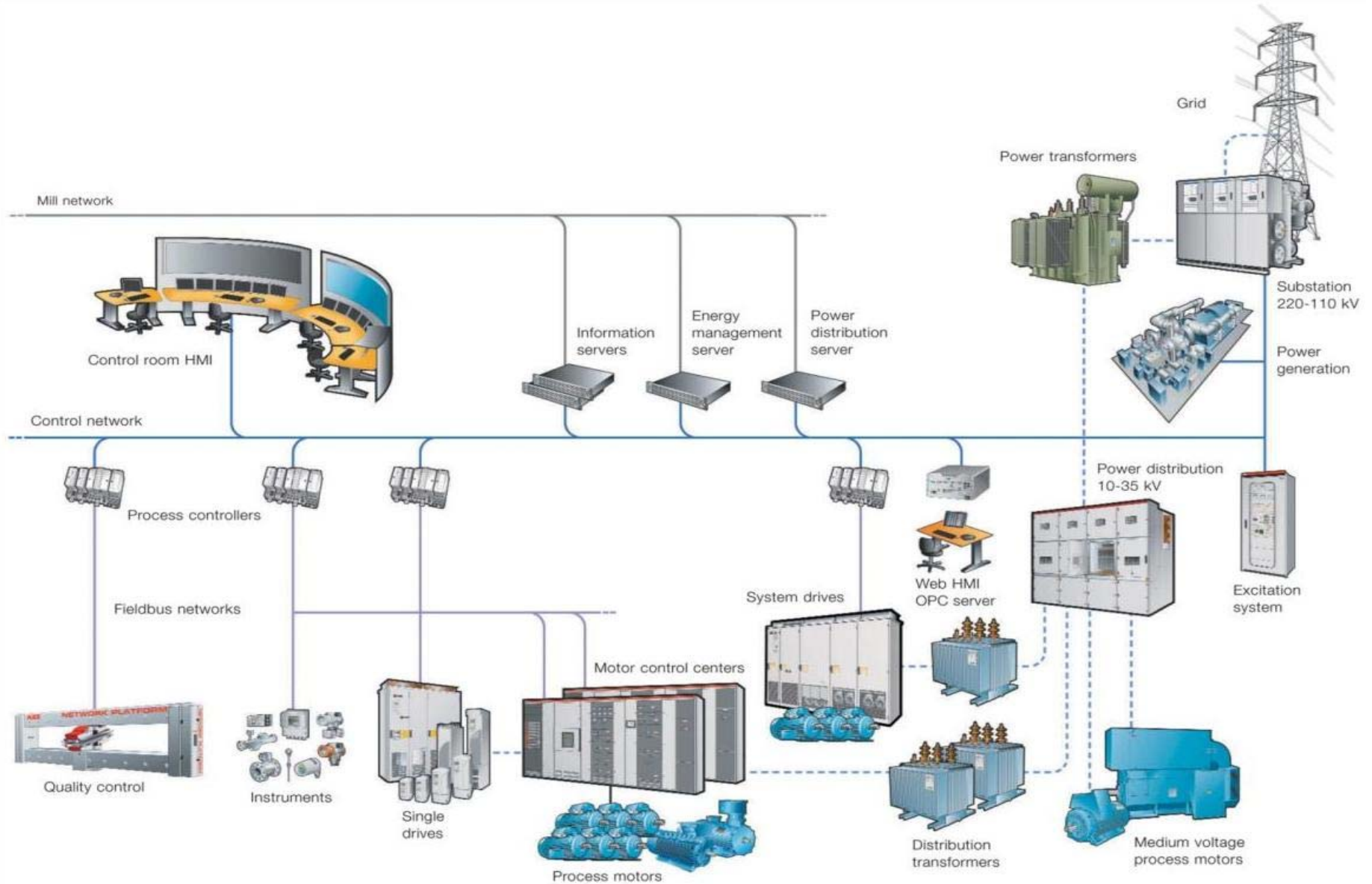


ABB energy efficiency solutions

Variable speed drives and premium-efficiency motors



- ABB Energy Efficiency Motor / Drive Assessments help customers identify where energy use can be reduced - - thereby saving money and environmental impact
- ABB offers a full range of AC and DC motors, NEMA premium efficiency motors (EISA); IEC motors, synchronous reluctance motor/drive solutions ; motors and generators for hazardous areas, marine and special applications solutions; as well as HV and synchronous motors and generators ABB also offers specialized solutions such as the Baldor Cooling Tower solutions
- ABB is the number one supplier of VSDs – which typically reduce energy use by 20% to 50%, reduce wear and extend life of system. Modest speed reduction = significant savings. Some drives include built-in energy calculators
- ABB also provides useful energy savings calculation tools such as PumpSave and FanSave to compare traditional flow control methods to VSD control. Tools available on the ABB web site

Synchronous Reluctance Motor (SynRM) and drive systems – optimized pump and fan applications



- High output SynRM packages combine conventional, proven stator technology and innovative magnet free rotor design with best-in-class industrial drive and advanced software
- Optimized for pump and fan applications
- Synchronous reluctance technology delivers better power density and higher energy efficiency than with the equivalent induction motors
 - Saves space with a smaller and lighter motor design
 - More motor power from the same size and space
- Efficiency level meets or exceeds IE3 induction motors' efficiency in VSD operation
- Cool, compact motor cuts the cost of running - the rotor has neither magnets nor windings, and thus suffers virtually no power losses making it uniquely cool
- Superior reliability minimizes the cost of not running - bearing failure causes about 70 percent of unplanned motor outages. Bearings operate at low temperature
 - Extends bearing lifetime and service intervals
 - Reduces maintenance costs
 - Improves reliability



Baldor RPM AC™ Cooling Tower with direct drive motor and variable speed control system



Fan mounted directly to motor (versus to gearbox) eliminates some of the historically biggest maintenance issues including gearbox failures, oil leaks, failed drive shafts, misaligned drive shafts and excessive vibration.

BALDOR
A MEMBER OF THE ABB GROUP

- Efficient, reliable and quiet motor and drive technology for cooling tower applications
- RPM AC Cooling Tower Direct Drive motor designed exclusively for cooling tower industry
 - Interior permanent magnet rotor technology
 - Interchangeable with many existing cooling tower gearbox designs
 - Fan mounts directly to the motor thereby eliminating entire gearbox and driveshaft torque transmission components – reduced maintenance
 - Compact, quiet and energy efficient
- Variable frequency control provides the ability adjust the motor speed and thus associated fan speed as needed thereby considerable energy can be saved

Power quality solutions



- ABB has the latest technology to improve power quality by eliminating disturbances and improving power factor for
 - LV and MV industry networks
 - Power transmission and distribution
- Power transmission and distribution power quality – FACTS
 - SVC for industry – Static VAr Compensator for reactive power compensation
 - SVC Light® for industry – STATCOM for industry (Static Synchronous Compensator) - focused reactive power compensation
 - SVC for utilities – rapid operating Static VAr Compensator
 - STATCOM for utilities – advanced static VAr compensator
- MV and HV power quality capacitor and filter solutions
 - Shunt banks
 - Harmonic filters
 - Capacitor units
- Voltage management control software for HV Utility application (multiple power quality devices for PF, voltage regulation, etc., control)

Extended Automation System 800xA

Commitment to a common architecture

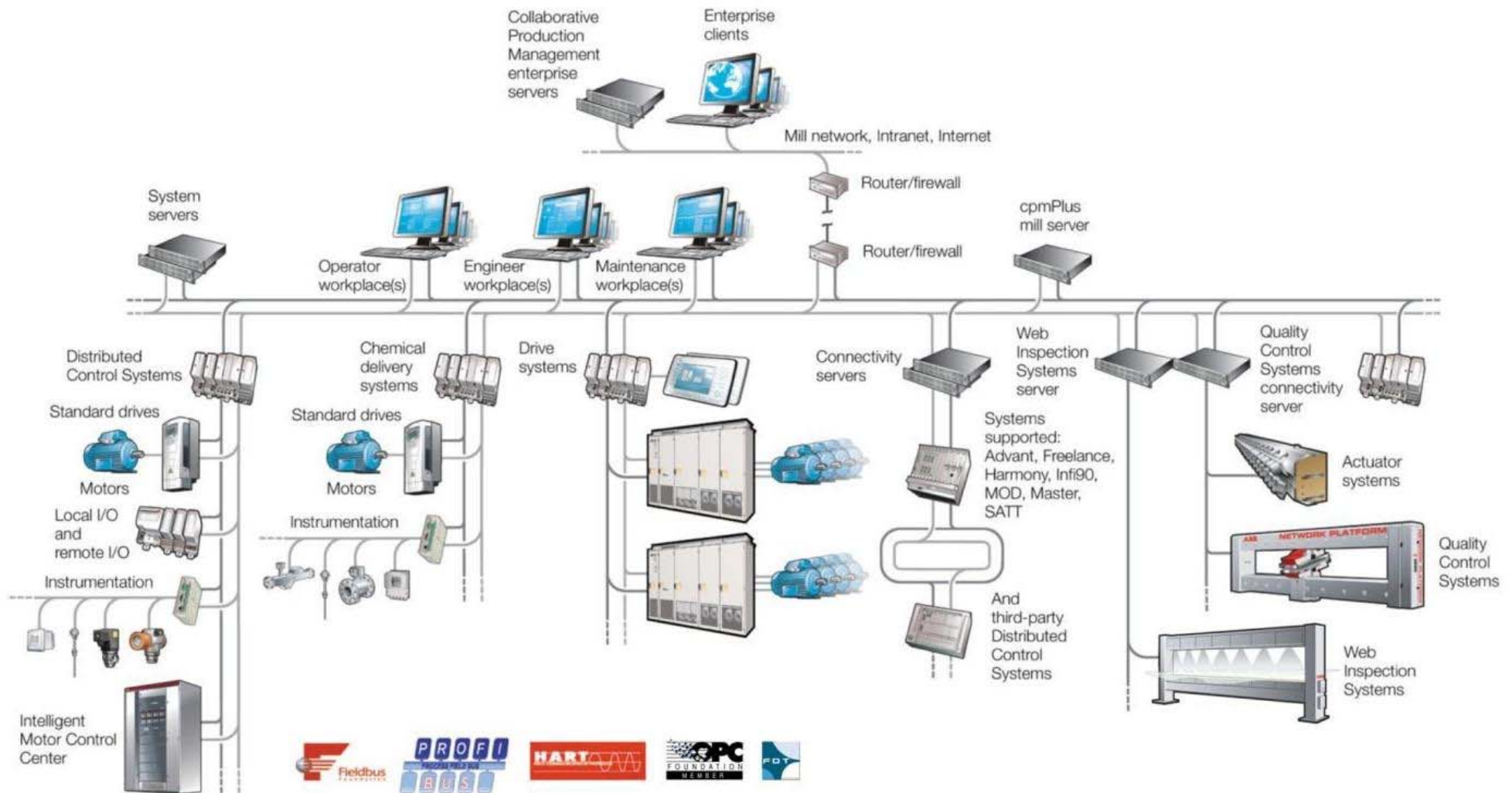
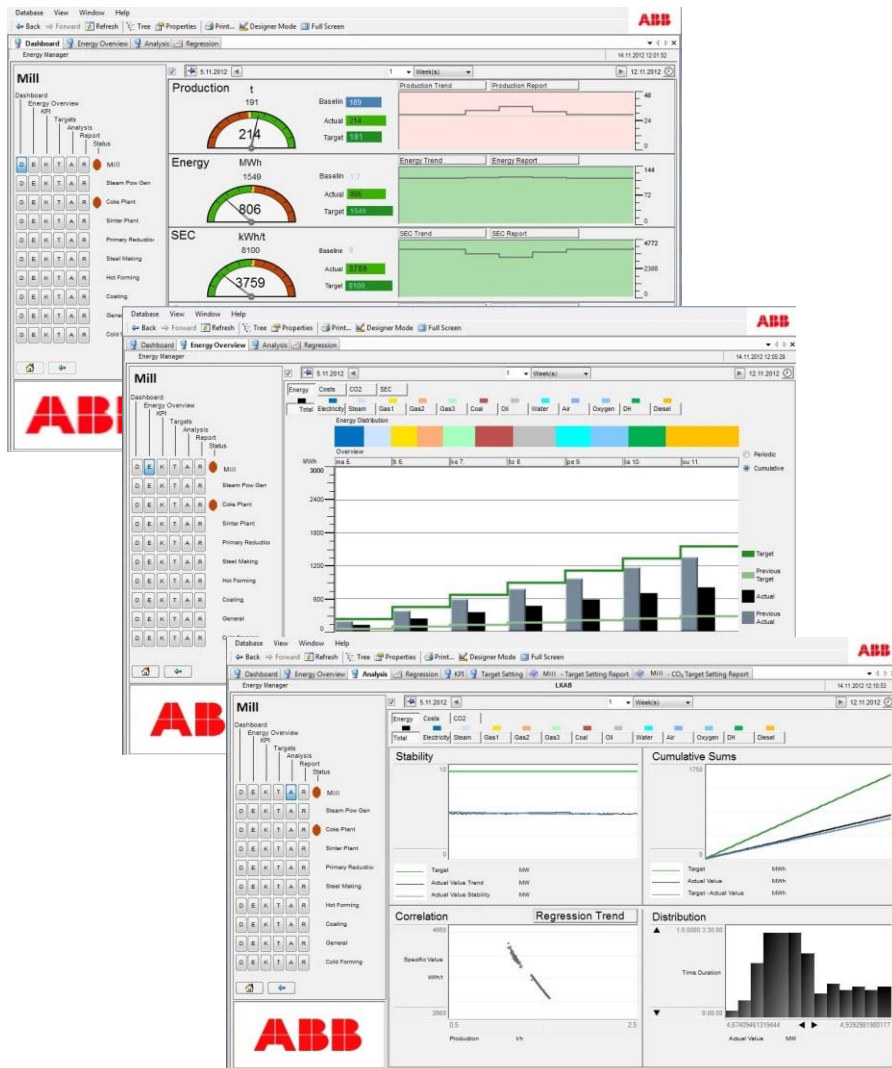


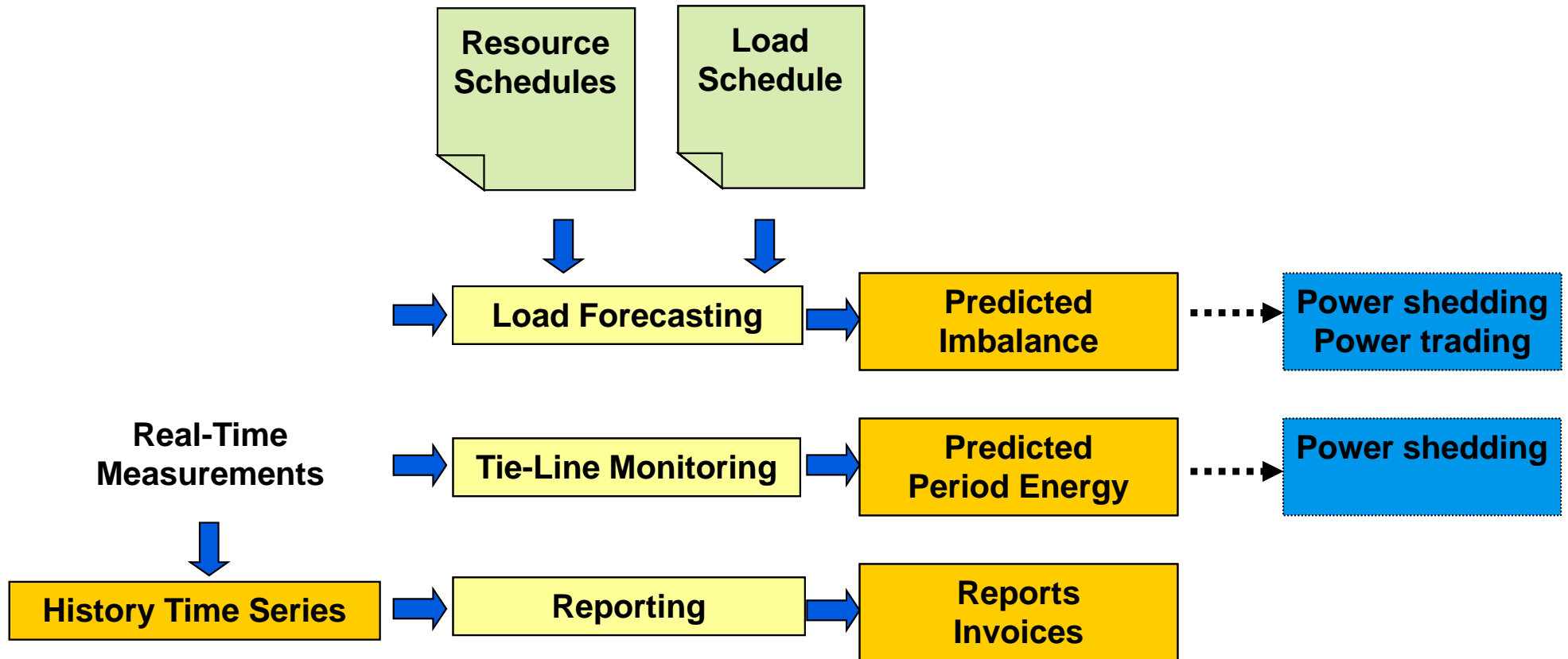
ABB energy efficiency solutions

cpmPlus Energy Manager modules



- Energy monitoring and reporting tool - - lower costs – dash board
 - User configurable visualization tools for monitoring, targeting and analyzing
- Energy load planning - minimize electricity purchase costs
 - Predict accurate energy plans to reduce demand charges / penalties
- Energy optimization - optimize electricity procurement and consumption
 - Optimize energy sources (internal and external) and / or selected energy consumers to minimize costs
 - Real-time balance monitoring - all process areas simultaneously against energy sources
 - Energy resources scheduled and dispatched to minimize total energy cost or maximize total profit

cpmPlus Energy Manager



- Benefits:

- Lower balancing power and cost
- Lower demand charges and penalty fees
- Higher energy efficiency and lower cost

ABB energy efficiency solutions

Services - Boiler Fingerprint analysis



- Energy Savings
- More Responsive to Process Steam Demands
- Extended Operating Range
- More Reliable
- Improved Safety
- Reduced Carbon Footprint

Focused areas:

- Inspect boiler hardware and software to ensure proper instrumentation and safety measures are in place. Test actuator operation. Confirm measurement accuracy. Visually inspect and test instruments, valves, and control logic
- Boiler stability - evaluate boiler control loops under normal operation to determine steady state stability. Review operational history.
- Boiler load test - Check boiler air and gas flow curves and ensure safe and efficient boiler performance throughout operating range
- Conduct dynamic response tests. Evaluate disturbance rejection and load change recovery

Pulp and paper industry-specific Instrumentation to enable energy savings

Power

Process

Performance



Lorentzen & Wettre
A MEMBER OF THE ABB GROUP



KPM
A MEMBER OF THE ABB GROUP

- Lorentzen & Wettre products contribute to improving paper quality, reducing manufacturing costs, and reducing the consumption of raw materials and energy
- Laboratory products – industry standard for desktop and automated laboratory measurements
 - Pulp and paper properties
- Paper optimization products
 - Microwave moisture sensors
 - Handheld devices
- Services
- KPM products
 - Full range of consistency transmitters, break detection and pulp samplers
 - All technologies available – microwave, rotary, blade and optical
 - Paper optimization products

ABB energy efficiency solutions

Measurement products enabling energy efficiency



- Operational profitability – we help customers improve mill productivity and energy efficiency
- Capital productivity – ABB products and services help customers minimize project capital costs and lower ongoing fixed costs
- Risk management – we are committed to meeting our customers requirements for schedule, quality and project safety
- Global responsibility – our health, safety, security and environmental offerings help companies achieve the highest levels of social responsibility

Measurement products enabling energy efficiency

Five global product groups



Force Measurement



Analytical Measurement



Flow Measurement



Field Instruments & Devices



Service



Flatness



Rolling Mill



Cont. Gas



Comb. Gas



Magnetic



Coriolis



Pressure



Level

Start-up & Commissioning

Spare Parts & Repairs

Calibration

Upgrades & Migration

Professional Training Programs

Flexible Service Agreements

Corrective & Preventive Maintenance

Optimization & Advanced Services

Full Service Agreements



Dimension



Web Tension



Gas CG



Rem. Sensing



VA



Vortex



Temperature



Positioners



Cylmate



Torque



Spectroscopy



pH/Condy



DP



Thermal Mass



Actuators



Recorders



Weighing



Tools



Water Mun.



Water Power



Gas Flow



Comp./RTU



Controllers



Asset Man.

ABB

A global leader in power and automation technologies



145,000 employees in about 100 countries

\$38 billion in revenue (2011)

Formed in 1988 merger of Swiss and Swedish engineering companies

Predecessors founded in 1883 and 1891

Publicly owned company with head office in Switzerland

A leader in all our core businesses:

- Electricals, automation, controls and instrumentation for power generation and industrial processes
- Power transmission solutions
- Power distribution solutions
- Low-voltage products
- Motors and drives
- Intelligent building systems
- Robots and robotic systems
- Productivity, reliability and efficiency services

**Power and productivity
for a better world™**

ABB