ABB Group Technology Report

Our commitment to innovation

Published November 2002

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75%

Average percentage of business based on products developed in the last five years.

$1.6bn

Total investment in research and order-related development, according to U.S. GAAP (U.S. dollars).

27%

Percentage of software-related patent first filings to total first filings.

Jürgen Dormann,
Chairman and CEO, ABB Ltd

Quality and reliability are key, says ABB chairman and CEO

“Research and development is the lifeblood of all technology-based companies.”

ABB’s history of innovation stretches back more than 100 years and includes many real breakthroughs: the world’s first three-phase power transmission system; the world’s first self-cooling transformer; the world’s first high-speed locomotive using a direct drive system; even the world’s first synthetic diamond.

It is a history we pride ourselves on and is the reason ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact.

According to recent studies, the top 600 international companies increased their investment in research and development last year. Even industries that were subject to poor market conditions, like information technology, telecommunications and media, increased R&D spending in 2001.

We invest roughly seven percent of revenues – US$ 1.6 billion – in research and order-related development each year. We monitor this spending carefully, and all future research is knitted into the fabric of our business strategy – to help industry and utility customers become more competitive while keeping an eye on the environment.

ABB’s R&D lineage stretches back more than 100 years through its parent companies, Asea AB of Sweden (est. 1883), and Brown Boveri & Cie of Switzerland (BBC est. 1891). They merged to create ABB in 1988, bringing together more than a century of innovation.

2002
ABB certifies 35,000 power and automation technology products to a new information standard. This brings to life the patented Industrial IT concept, which links products and services with the information technology needed to run them more efficiently.

Chairman and CEO continued

Topnotch technology

ABB's customer base cuts across many industries. It consists of consumer goods companies like Ford, Volvo and DaimlerChrysler, brewers Heineken and Carlsberg, and mobile phone makers Nokia and Ericsson. There are utilities like Endesa of Spain, Pacific Gas & Electric Company of the U.S. and RWE of Germany; oil giants like BP, Shell and ChevronTexaco; pulp and paper makers like StoraEnso and mining companies like Inco; chemical makers like DuPont and Dow, and pharmaceutical companies like Merck and Pfizer.

This abbreviated list is made up of market leaders who stay on top because they produce excellent products. To do so, they need excellent technologies that surpass expectations for efficiency, cost, productivity and environmental standards, among other things. That's where we come in – as a true technology partner, in good times and bad, reliable to the core.

Capital expenditures in most of our customer industries will remain depressed in the short to mid-term. As a result, customers are looking for ways to optimize the technologies they already have in place, to get more out of existing operations and extend the lifetime of their assets.

Cleaner power, fewer emissions, faster production

In power technologies, this means a greater focus on high quality, cost effective products and processes that help power producers and distributors extract the greatest value from existing plants or grids.

For example, new ABB software called GridView simulates the way power markets work. Operators of large grids get a complete overview, which allows them to analyze fuel, costs, capacity of power plants and energy conversion efficiency. Another good example is our package substation, which builds high-quality products into a modular design that is delivered faster and costs less to maintain.

In automation, this means creating new processes to optimize existing production lines and squeeze more value from the supply chain. For instance, our new high-voltage motors and direct drives are slashing costs and improving efficiency in pulp and paper, aluminum, chemical and petrochemical plants, while our new heavy duty robots are lifting cars, heavy forged parts in foundries, and even crates of beer and champagne.

The same also holds true for the oil and gas industry, where environmentally-friendly technologies are needed to more efficiently exploit resource reservoirs and lower the cost of refining raw materials. ABB's clean fuel technology, developed in a joint venture with a leading oil and gas company, reduces harmful emissions by using a new process for making alkylate, the key ingredient in gasoline.

2002
ABB delivers its 100,000th robot.

1997
ABB sets out to create a single Industrial IT architecture for its entire range of technologies and products.

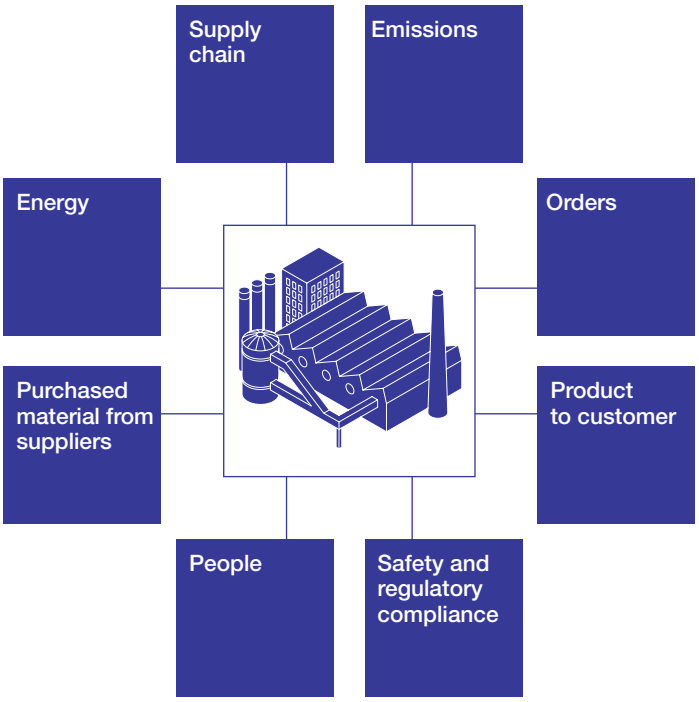


ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance – from supply chain management to energy usage and people – while reducing environmental impact.

The brand and what it stands for

The ABB brand is built on strong technology and our pioneering spirit. We try to take the best ideas and turn them into tangible products and solutions as fast as possible. Take a look at our intensity of innovation figures – on average 75 percent of our products have been developed in the last five years. That's a pretty remarkable figure.

It is a testimony to our people, the researchers and scientists, the engineers and programmers, the sales staff, factory workers and management, who make this great company what it is today.

Technology outlook

Our technology spending will continue to match customer demand. Technology is the foundation of our prosperity, and the source of so much that is good in our lives. It brings power to our homes and keeps us warm at night. It is the enjoyment of watching a factory hum with clockwork precision, the pleasure of driving a car or settling back to read a favorite book.

It helps you get what you want, when you want it.

Sincerely,

Jürgen Dormann,
Chairman and CEO, ABB Ltd

1990
Azipod (Azimuthing Podded Drive) is conceived to give ships more maneuverability with a motor inside a submerged pod that is 360° steerable.

1988
Asea and BBC merge to form one of the world's largest electrical engineering companies.

1984
Asea delivers generators for the world's largest hydroelectric power station at Itaipu in Brazil.

1974
Asea invents and launches one of the world's first industrial robots.

1963
The first data transmission at carrier frequency is sent by BBC over a 735-kilovolt high-voltage line to a power station control unit.

1953
Asea is the first company in the world to manufacture synthetic diamonds.

Chief technology officer says speed and the environment are the focus

“ABB technology is the backbone of many industries.”

Take your car, for example. It’s very likely ABB robots helped assemble the car you drive in operations ranging from precision material handling, spot-welding and production of assembly units to the application of high-quality, environmentally-friendly paint finishes.

All of this equipment is powered by electricity which probably passed through a substation using ABB transformers, switches or circuit breakers, which may in turn be controlled by our Substation Automation or Network Control Systems for reliable, environmentally-friendly, cost-effective power transmission.

1950
Asea pioneers efficient, long-distance power transmission using high-voltage direct current technology.

1944
BBC develops the first high-speed locomotive with a direct drive system.

1933
BBC invents a new concept for building turbine rotors.

You might even operate your car with our "clean fuel," extracted from reservoirs using ABB's upstream equipment and processed in a refinery with ABB cracking technology.

Technology platforms eliminate unnecessary research, and save both ABB and its customers money. We work in four main areas:

- Power technologies
- Automation technologies
- Engineering and manufacturing technologies
- Oil and gas technologies

A large part of our work is concentrated on Industrial IT, the platform which brings inter-operability to our many and varied products. Industrial IT represents our vision of future industrial systems and solutions, where information technology is harnessed at nearly every stage of the industrial process to increase efficiency and profitability.

ABB is also building the foundations of future product development with intensive research in areas like wireless technology, Micro-Electro Mechanical Systems (MEMS), mechatronics, power electronics, and software development.

A global network links our own experts with scientists at more than 50 prestigious universities and research institutions around the world, where we monitor the frontiers of technology to spot opportunities for our customers.

Value creation is the primary objective of our R&D activities. Unlike many companies, ABB researchers work alongside colleagues in the business divisions – from sales and marketing to procurement and planning. Active dialogue between researchers and the frontline ensures that new products meet customer needs. We see four major customer needs:

Profitability: means squeezing maximum value from assets by increasing output, yield and uptime, or reducing the capital needed to produce a certain output.

Speed: our platform concept and sophisticated engineering and manufacturing processes enable us to respond quickly to customer needs. For example, our transformer factory in Poland can manufacture transformers to order within 24 hours.

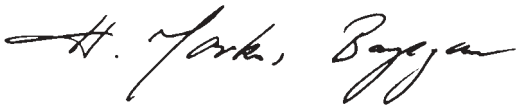
Quality and reliability: is built into ABB products and systems to ensure customers get exactly the performance they need.

Environmental compatibility: our products and systems lower energy consumption and reduce pollution levels.

In summary, ABB's technology platforms are designed to address customer needs with products and services that deliver more value faster, with quality and reliability, while firmly controlling environmental impacts.

Welcome to technology, the ABB way.

Sincerely,



H. Markus Bayegan,
Chief technology officer, ABB Ltd

1932
Asea builds the world's first self-cooling transformer.

1901
BBC builds the first steam turbine in Europe.

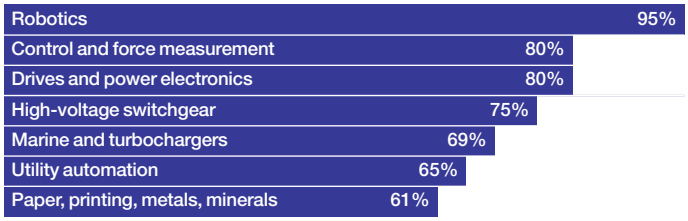
1893
Asea builds the first three-phase transmission system in Sweden.

1891
BBC is the first company to transmit high-voltage AC power.

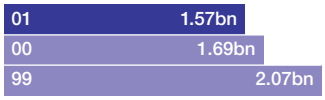
Who, what and why?

By continuously developing new technologies and improving existing ones, ABB makes utility and industry customers more competitive while minimizing environmental impact.

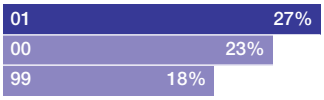
Industrial IT is ABB's patented concept for linking products and services together with the information needed to run, service and maintain them.



Intensity of innovation: percentage of business based on products developed in the last five years.



Group investment in research and order-related development*
*according to U.S. GAAP (U.S. dollars)



Percentage of software-related first filings to total first filings.

Industrial IT

Who?
All of ABB's research and business managers are working on the Industrial IT initiative. It is the company's largest-ever technology undertaking.

What?
Around 35,000 products and services have been Industrial IT-enabled to date, which means they come with all standard information in an electronic format.

Why?
Standardizing information formats and organizing them into a user-defined architecture reduces waiting times and allows for cost-efficient, copy-and-paste engineering.

Outlook
ABB is working to move its products and services to the next stage in Industrial IT certification – which connects the products and services with the larger systems in which they operate.

w www.abb.com/industrialit

Power technologies

Researchers and developers in the laboratories for power technologies largely serve industrial and commercial customers, as well as electric, gas and water utilities.

Insulation technology, current interruption and flow control of electrical energy from large transmission systems to household applications.

Ordering power equipment used to take a long time. In deregulated markets, delivery times must be faster. To increase competitiveness, customers need more and better information to make their buying, planning and executing decisions.

New materials and new ways of manufacturing components will improve product performance. Industrial IT will help connect ABB's power technologies and automation technologies.

w www.abb.com/ptp

Automation technologies

Researchers and developers in the laboratories for automation technologies largely serve industrial and commercial customers.

Micro-Electro Mechanical Systems (MEMS) and sensors, power electronics, wireless communications, mechatronics, control and optimization and software technologies.

Capital expenditures in plants and factories around the world are down. ABB's customers are seeking optimization technologies and process improvements rather than large-scale, capital intensive products.

After certifying 35,000 products to the Industrial IT standard, ABB will focus on advanced process modeling for plant control and asset optimization.

w www.abb.com/atp

Engineering and manufacturing technologies

Researchers and developers in the laboratories for engineering and manufacturing technologies serve customers from every ABB business division.

New process concepts and state-of-the-art information technologies for world class engineering, manufacturing and service.

The huge influx of information gathering systems, from enterprise resource planning to supply chain management, has created a "beast of complexity." ABB is working to pool its knowledge – gleaned from more than 100 years in power and automation – to deliver the right information, in a useable form, at the right time.

ABB's Industrial IT architecture will make Computer Integrated Manufacturing (CIM), the process approach that failed in the 1980s, a reality.

w www.abb.com/technology

Oil and gas technologies*

Researchers and developers in the laboratories for oil and gas technologies primarily serve customers from the Oil, Gas and Petrochemicals division.

Floating platforms, subsea production systems, risers, compact processing for subsea and topside applications, reservoir monitoring and remote control. The catalysis and chemical processes research area looks at advanced reaction and separation systems for the refinery and petrochemical industry.

Capital expenditures are down, which means the industry is looking for more optimization technologies to improve existing production sites.

More technology partnerships with selected key customers and universities, to ensure new products and systems are aligned with client needs and requirements, and to ensure a window on cutting edge technology.

w www.abb.com/ogp

* The Oil, Gas and Petrochemicals division is scheduled for divestment by the end of 2003.

The sweet taste of success

ABB's patented Industrial IT architecture and products are running some of the world's most complex plants and factories. ABB's technology is changing the way power and automation customers produce everything, from cars, pharmaceuticals and champagne to motorcycles, cement and paper.

For example, ABB delivered the first Industrial IT-based automation system for Carlsberg Denmark in the Tuborg Fredericia Bryggeri brewery.

When Carlsberg decided to replace the yeast tanks at the brewery, ABB was again asked to upgrade processes in one of the most sensitive areas of the operation: no yeast – no beer.

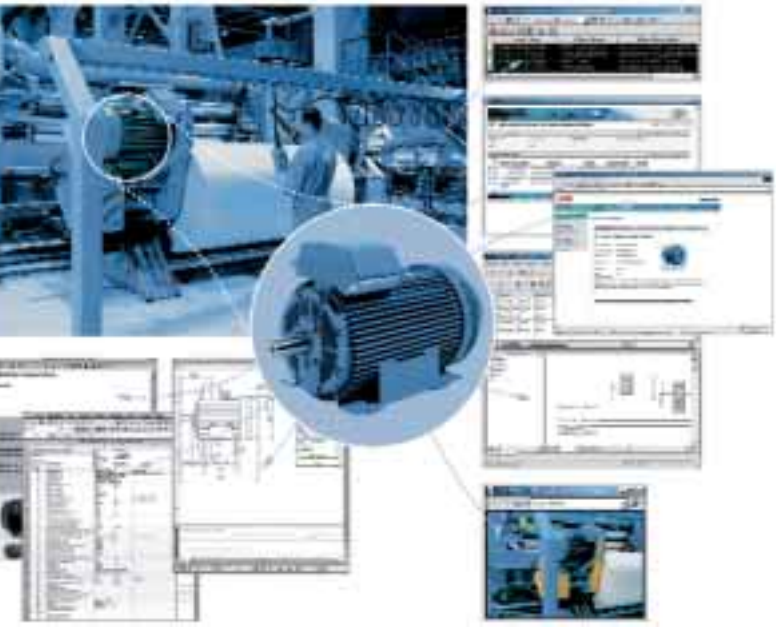
ABB replaced an existing ABB control system with the Operate IT Process Portal. After the new platform was installed, Carlsberg asked ABB to install Operate IT in other workstations at the brewery.

Carlsberg considers the installation of Operate IT a huge step forward.

The red line holding technologies together

The growth of information technology (IT) in industry in recent years has accelerated productivity in ways never before imagined.

But, it was only a beginning. Early users of IT learned quickly that there is a world of opportunity ahead. For example, the automotive industry, highly productive and already quite efficient, could reduce delivery times by 50 percent or more if it better managed the flow of order information.



Industrial IT links products – in this case a motor on a paper line – and the information needed to run, service and maintain them. The information – i.e. drawings, control diagrams, and quality standards – is stored electronically for easy retrieval.

Market characteristics

Businesses typically work with a large number of highly specialized and rather complex systems. These systems are not always linked together. For many typical business decisions, information has to be collected from several systems, with the involvement of specialists who understand the specific information formats. Complicating matters, a great deal of information is still only available on paper, for example, in older power plants and factories.

Recent technology developments (like Web services, Web-sphere, Java, .NET, and COM) have provided the tools to integrate information from many disparate IT systems. However, this "total integration" vision poses a new challenge: integrating systems to meet the needs of many different users. Everyone needs access to the information, from plant operator to buyer, supplier and manager, and they all have specific needs. This "beast of complexity" has until now limited real progress in the area.

How it works

ABB's Industrial IT architecture addresses this problem with an intuitive, easily understood, user-defined information platform. It works across all hierarchical levels of a business – from product information on the shop floor to enterprise systems in the boardroom. It also works between several enterprises, linking customers, buyers and suppliers if the need arises.

Much like working with Windows Explorer, users can configure the information to their specific needs with simple drag and drop operations. Industrial IT software provides real-time links to all important systems, from the flow of supplies to the product rolling out the door.

A big opportunity here for ABB lies in its huge installed base (more than 30,000 plants worldwide), and the fact that Industrial IT works with classical systems. The information is presented on the familiar Windows platform, including icons, menus and pointing tools, but adds an additional feature – a powerful overview functionality – which is more intuitive for the everyday person.

30,000 plants worldwide

Did you know? ABB has an installed base of 30,000 power plants and factories worldwide.

Industrial IT is a fully-integrated, easy-to-use and flexible information architecture which connects disparate products and systems so they can communicate with each other.

Benefits

The main value of this Industrial IT architecture is that it provides guidance for product and solution developers and for customers who want to migrate into a fully integrated, easy-to-use and flexible information structure. The waiting time for products and services is cut dramatically, customers are happier and end-users get what they want, when they want it.

Strategic initiatives

There are three main Industrial IT initiatives running in parallel. First, ABB is migrating its automation product and system business to the new Industrial IT-enabled platform. Several hundred customers are currently using these systems. Second, ABB is certifying all its products to the Industrial IT standard (35,000 at year-end 2002). This process includes products which have no special IT content like switches, transformers and motors, and entails documenting all product information electronically. Third, ABB is using Industrial IT to improve productivity in selected industries.

Several main areas have been targeted for productivity improvements. One is to increase plant uptimes with improved maintenance processes – based on better and faster information. Another is the optimization of plants with respect to criteria like energy consumption, environmental impact, minimal inventory and throughput time. ABB does this by integrating information from the many systems (for example, automation, enterprise resource planning and supply chain management). Thirty pilot projects are in an advanced phase.

The customer's voice

Thailand's Bang Khen water treatment plant supplies many of Bangkok's six million inhabitants with clean water. The Metropolitan Water Authority (MWA) decided to automate the plant and selected ABB's technology platform to control and monitor the filtration process in the 32 beds. "We're very pleased to have installed ABB's control system for our filtration processes," says Viroj Changtongkam, director of electrical maintenance at MWA. "It's easy to engineer, easy to operate and easy to maintain. It also enables us to extend and integrate the system very easily in the future."

Outlook

ABB will move its products and services to the next stage of the certification process, geared to connecting disparate products and services, integrating them within a system so they can communicate with one another, thereby optimizing the entire system.

Industrial IT

Industrial IT simplifies life in the control room with “Object” icons and organized information bundles called “Aspects,” easily and quickly connecting users to the smallest detail of a huge operation.

The architecture and how it works

The complexity that comes from trying to integrate many IT systems in a business is incredible. Have you ever experienced the difficulty of trying to set up a new home electronic system? Imagine that level of difficulty multiplied by a thousand and you start to understand the need for Industrial IT.

Traditionally, businesses worked to break down huge information clusters into specialized functions. For example, dedicated IT systems – for enterprise resource planning and supply chain management – were broken down into specialized functions to better track many variables. This was called dividing and conquering.

The new view

Industrial IT changes this paradigm: information is organized around generic, cross-functional “Objects” that are important to an operation. Objects can be anything from installed equipment, like robots, vessels, valves, transformers and switches, to products, like cars, pharmaceuticals and even electricity. In some cases, Objects are less tangible: sales or manufacturing orders, and sometimes blueprints for a certain product.

Clicking on an Object icon brings up a menu showing all the information connected to that Object. This information is called an “Aspect” of the Object. To bring the idea to life, picture a PC with a production line overview of robots building cars. Clicking on one of the robots welding a car will bring up all the information associated with the robot – design drawings, control diagrams, maintenance information, location and quality standards.

ABB is a leading supplier to the hot flat steel industry. Here, Industrial IT brings together electrical equipment, drives and motors, automation and production control.

Powerful software at the core

A typical industrial plant is made up of tens of thousands of Objects, each of which has roughly 30 Aspects. Grouping information as Aspects around Objects automates the time-consuming collection of information from various systems and thereby cuts the time wasted waiting for information.

This generic structuring concept is supported by powerful software called the Aspect Integrator Platform (AIP). The AIP offers basic infrastructure services like open interfaces for integration with other systems, history log, user identification and authorization.

A specific new function allows users to access and exploit Industrial IT opportunities within the system. Objects and Aspects can be copied from a library – gleaned from ABB's more than 100 years experience in power and automation technology – into a task-specific system. Objects can be organized into Object hierarchies, the widely used way of breaking down a complete plant into subplants, systems, subsystems and products.

Structures upon structures

One such structure is not enough to manage the complexity of most plants. And different businesses need different structures for the Objects that relate to their job.

For example, plant operators need a functional structure while maintenance staff needs a location-based structure. The AIP supports a multitude of such structures – no competitor offers this – allowing each user to drag and drop the Objects into a hierarchy that meets his or her needs. Regardless of the arrangement, the architecture works in the background to maintain the integrity of the relevant Objects, whatever the structure or user perspective.

The future

Industrial IT is creating dramatic possibilities for "copy-and-paste" engineering – whereby entire subsections of the industrial system can be redeployed from one process or plant to another with significant cost savings. Further improvements in productivity will be achieved as the compatibly-structured Aspects of different devices automatically interact to optimize the system in which they are working.

Industrial IT

Industrial IT is at the heart of the ultra-modern Freiberger brewery near Dresden, Germany, which produces 65 million liters of beer annually.

Pulling it all together

Industrial systems are built from a large number of products: “classic” hardware products like motors, drives, robots, all kind of power devices, and a fast growing portfolio of software products like control algorithms, optimization packages and maintenance software.

The paperless plant?

The distinction between hardware and software is becoming more and more blurred. Increasingly, traditional products are equipped with intelligence (embedded Web servers, for example) and connected to communication networks.

Even unconnected products demand large amounts of information for users in the different phases of the product lifetime. Installation manuals, maintenance instructions, commercial information – all are needed. This is a huge amount of information. In the best case scenario, this information is handled by a special documentation system. In the worst and most common case, it is stored as paper documentation.

Industrial IT transforms masses of paper documentation into a useable, electronic resource. It also integrates this information within an overall architecture, a major departure from earlier models which placed the information in a wide variety of control, maintenance and enterprise resource planning systems.

ABB opened a new research and development center in India during 2002 to focus on software development and Industrial IT.

The entire package

Here's how it works. A customer who buys an Industrial IT-enabled product gets all the associated Object and Aspect information as a software replica. The replica can be copied and pasted into any user hierarchy, eliminating the need for multiple entries of data. It also eliminates the need to build new IT systems for each new product.

This works because ABB delivers every bit of information in a strict standard format. Every product goes through a rigorous certification process that defines the basic common Aspects. Product identification, data sheets, installation, operation and application information, technical references and maintenance and service manuals are all collated and added to the software replica.

These can be expanded to include electrical and mechanical drawings, contact lists and product declarations, among other things. A certified product is labeled with the Industrial IT Enabled symbol.

All relevant ABB products certified

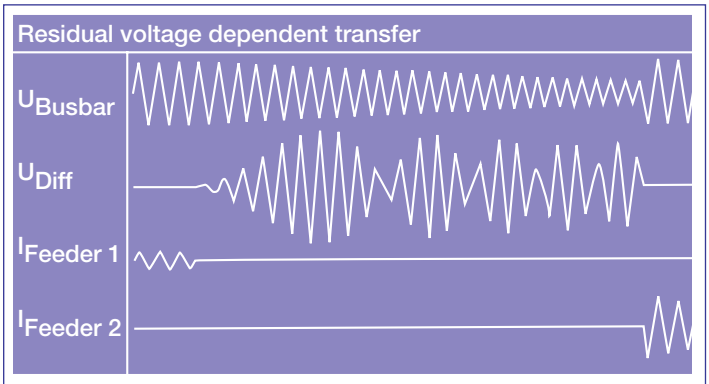
Some 35,000 ABB power and automation technology products – hardware and software – were certified at the end of 2002. ABB is the first to integrate these historically very separate business lines into the same information architecture system. The certification process is also open to third parties and currently includes 23 companies.

Communicating products like controllers or instruments can exchange more powerful information within the Aspect Integrator Platform. This platform involves three additional certification levels on top of the described basic level. At the top of this process, entire systems can optimize themselves.

Customers buy in

One example: ABB is piloting the automatic documentation feature in a customer project for an entire substation. Each part of the substation has its software replica stored and electronic information available at the click of a mouse. This project was recently presented at the high profile Cigre conference in Paris, where many of the world's first technology breakthroughs are unveiled.

Every second counts



If the medical equipment at a hospital stops due to electrical failure, the damage can be catastrophic. And in some continuous processes like steel making, aluminum smelting, unexpected power interruption can be financially crippling.

Line failure is not a common or frequent problem, but can occur from time to time in even the most advanced plants. Most vulnerable factories have two independent power supply lines as insurance against power interruption or voltage sags. But the question is how to safely switch power to the second line when the first line fails?

Conventional power switching systems can do it, often using bulky, expensive and dedicated equipment that needs large racks to support detection and switching equipment. ABB now offers a high speed transfer switch which reacts virtually instantly in the event of power failure because it is uniquely designed to anticipate potential power interruptions and immediately switch to a second power source. The rapid power switch is usually done in less than two cycles, much faster than most conventional power switching systems.

Real-time control of the high speed transfer switch is based on a new algorithm and software, and has undergone extensive field trials. The short power transfer time helps preserve power quality, and protect sensitive and costly production equipment from damage during power interruptions, creating the kind of security that is much appreciated by our customers.

Power to the people

ABB is the recognized leader in power technologies. Research and development in this area is focused on better serving industrial, commercial and utility customers with products that are geared to making them faster, more efficient and ultra-competitive.

ABB's technical solutions include design and construction of systems for clean rooms like this one manufacturing vacuum interrupters. Manufacturing to international standards means no more than ten particles of dust or dirt per cubic foot of air in a clean room.

Market characteristics

Traditionally, ordering power equipment took a long time. As power markets deregulate, delivery times must get faster. Utility customers need complete and reliable information to make quick and decisive business plans. ABB is shaping the future of this market by linking information systems and Internet technology with core production processes. As a result, customers have their orders filled in weeks rather than months, days rather than weeks, and end-users get more reliable, cleaner and cheaper power.

Technology areas

ABB is involved in three main areas of power technology. The first, insulation technology, is needed for both alternating and direct currents. It uses insulators ranging from polymeric material to SF_6 gas, and is a basic need for almost all power products and systems. The second, current interruption, is the art of handling electric arcs but also includes electronics for converters. The third, the ability to control the flow of electrical energy from large transmission systems to household applications, is supported by a number of Industrial IT technology areas.

Research programs

ABB has a global laboratory running four research programs to support the development of power technologies. The power devices research area works on current interruption and limitation. Utility systems deals with system-specific research and development issues for customers. The nanotechnology research program is critical to the development of surface structures and material parameters, not only for power technology devices, but also for specific applications. Another program focuses on sustainable development and the related life cycle assessment of ABB products.

15x faster

ConocoPhillips, one of the largest oil and gas producers in the North Sea, urgently needed a 5,700 kVA 12 pulse rectifier transformer.

Competitors offered delivery in 15 weeks. ABB delivered in seven days. Speed counts.

Industrial IT simplifies management of data and systems in complex power grids.

Industrial IT

Most of ABB's power technology products are Industrial IT-enabled. This is a basic requirement for R&D projects where the goal of research is new products (as opposed to process improvements or technology enhancements). Customers who operate energy transmission and distribution systems can manage enormous quantities of data with ABB's Industrial IT architecture. It readily supports customized asset management and service. All of ABB's engineering systems are developed within the Industrial IT architecture to simplify the management of complex power grids.

Strategic initiatives

At ABB, speed of delivery is an overriding concern. ABB's power technology products factories are being revamped to accommodate even faster production. New ABB product design is based on modular, standardized and highly customized systems, which is improving system engineering.

The customer's voice

ABB generator circuit breakers are a core component in power plants, and can interrupt the most powerful short circuit electrical currents. This is why Bechtel, the global engineering, procurement and construction company, selected ABB as its main supplier for these devices, and has now given us its Top Supplier Performance Award. M. Zeiger, head of global procurement at Bechtel, says: "We value greatly our relationship with ABB. This partnership provides mutual benefits and delivers state-of-the-art products as demonstrated by the generator circuit breaker, which holds the world record for the highest short circuit current interruption using self-blast technology. As a result of our successful relationship, Bechtel is happy to buy from ABB's entire portfolio: from breakers to drives and from switchgear to robots."

Outlook

Driven by ABB's Industrial IT initiative, information technology will increasingly permeate the research and development of all our products and systems. This will inevitably lead to more intelligent, communicative subsystems, which can be more efficiently managed. New materials and new ways of manufacturing components with the help of nanotechnology will continuously improve ABB product performance.

Power technologies

Full-blast breakers

When short circuits occur in the home, a 15-amp fuse might blow and the lights go out. It's usually a minor inconvenience, and once the fuse has been replaced, all is well again.

Now, imagine what would happen if the short circuit occurred in a generating station, where the electric current might be as high as 190,000 amps. Clearly, a special type of fuse is required to prevent major damage and power loss. Those fuses are called generator circuit breakers, and they perform a vital function.

Managing electric current higher than 190 kiloamperes is possible with conventional technology, but it requires installing tremendous cooling power for the electric arc, which switches on when the metallic contacts in the breaker chamber are disconnected. ABB uses the high energy content of the arc itself to create gas pressure high enough to "blow out" the electric arc. With this latest achievement, ABB has extended the well-proven "self-blast" technology to the highest current ranges ever handled by commercial circuit breakers.

"Self-blast" technology lets ABB design very compact devices not possible with conventional technology, creating a unique solution for the power market.

Daringly dry DC capacitors

Conventional oil-impregnated capacitors are very safe and reliable components used everywhere in an electrical system. Long-term degradation and potential oil leakage can be safely controlled by careful inspection and maintenance.

ABB's new dry capacitor can operate for decades without these additional measures. Its outstanding long-term reliability is based on a self-healing, dry design. The dry capacitor consists of tightly wound elements created by spraying polypropylene film with a microscopic coating of metal in an innovative, ABB-specified pattern.

The metalized film withstands higher voltage stresses than material used in conventional oil-impregnated capacitors, thus allowing increased energy density. In fact, the dry capacitor can store twice as much energy in half the space of a conventional capacitor, and its energy density is four times higher.

Low-voltage capacitors use foils and a self-healing mechanism in case of tiny punctures. This well-proven principle could now be applied to high-voltage products, and gives ABB capacitors a unique safety feature.

The ABB dry capacitor's extremely compact cylindrical design also allows for customized production, as capacitance simply scales with length. It is the component of choice in all DC installations where space is limited and reliability crucial. They are used in ABB High-Voltage Direct Current (HVDC) Light systems, and contribute to their superior performance.

GridView paints the big picture

To help clients in power generation and transmission markets plan for the future, ABB has developed GridView, a sophisticated computer simulation of how a power market operates.

Consolidation, mergers and a complex, borderless business environment mean electrical power markets increasingly rely on speed of delivery. Adapting quickly to rapidly changing business conditions requires accurate and low-risk planning and forecasting of customer needs.

GridView is an analytical software tool that identifies power grid bottlenecks and inefficiencies, improving the flow of electricity even in complex power markets.

GridView is a powerful and user-friendly software tool integrating the engineering and economic performance data of electric power grids. It was developed specifically for operators of large grids who face the challenge of squeezing top performance out of existing transmission and distribution lines.

GridView models entire power systems. From power lines and generating capacity to the performance characteristics of generating sets, including economic efficiency and energy conversion ratios, GridView creates an accurate and timely overview. It also identifies bottlenecks, and predicts when power lines may become “stressed” or congested.

A GridView simulation is a customized result based on a broad range of parameters, including type of fuel and cost, capacity of power plant, energy conversion efficiency, plant start-up cost, and local operational factors specific to the user.

GridView can even help customers determine the best location for a new power plant, taking into account technical and economic factors like raw material, delivery and land costs, power line congestion, taxes, etc.

GridView is a unique instrument designed to help energy companies manage and optimize business decisions.

Vital signs

Transformers are crucial, high-value links in any power system. If they fail or are removed from service, major parts of the grid will shut down. Naturally, utilities want their transformers to work perfectly for as long as possible.

This requires detailed knowledge of a transformer’s “well being,” so ABB developed a monitoring system that keeps complete, real-time control over this essential power component.

ABB’s Transformer Electronic Control (TEC) system is a significant improvement over conventional transformer data displays, which are usually provided by monitoring instruments on a component-by-component basis wired into a control room.

TEC collects data from all key points on the transformer and transmits a constant stream of information over a single fiber optic link back to the control room. TEC is efficient, easy to install and can enhance operating efficiency.

ABB’s Transformer Electronic Control (TEC) system monitors and protects big investments like transformers so power grids can run smoothly and efficiently.

TEC can, for example, direct a transformer’s cooling system to ensure different fans are used in rotation, switching coolers to manage usage, wear and efficiency. It can control and adjust tap-changer voltage. Discrepancies and potential malfunctions can be flagged, avoiding costly breakdowns and outages.

TEC’s asset management capability gives users condition-based rather than time-based maintenance. For example, wear in the tap-changer, pump and fan motors is monitored, and estimated time to service is predicted.

Unlike other monitoring systems, TEC can intervene operationally and make decisions and recommendations based on available data. Information needed for transformer control comes from just a few sensors.

All new ABB power transformers are built with TEC, which can also be retrofitted to existing products.

No assembly required

When you buy a car, you expect to drive it out of the showroom. There is no assembly required.

Customers who buy substations, which are essential parts of power transmission and distribution systems, have similar expectations. ABB can now deliver major time and cost savings to utility customers with a package substation called the PS-1.

Substations consume about 25 percent of the total capital cost of a transmission system. ABB realized that considerable savings could be achieved by packaging components more effectively.

The unique PS-1 substation was developed following an ABB customer survey to determine the acceptance of standard substation designs based on functional requirements. ABB engineers then analyzed the separate stages of the substation design and production process to improve design, manufacturing, civil engineering, installation and commissioning, as well as the material flows and transport paths.

Based on this formula, the PS-1 package substation is faster to manufacture and assemble than a traditional substation, because each step of the process is shorter.

The package substation is pre-assembled with internal systems made from the latest technology and materials. Delivery time has been cut in half to only six months because ABB designers have standardized substation components to eliminate complexity and speed up manufacturing.

In addition, much of the testing can be completed in the factory instead of on site. The package approach also helps ABB reduce the number of major vendors involved in creating a substation from more than 30 to fewer than ten, increasing quality.

A PS-1 package substation lets customers capitalize on ABB's vast utility experience, since they can select a product matching the technical and operating requirements of most applications.

The package approach resolves many of the technical alternatives of substation design and manufacture, reducing the need for a utility's engineering department to become heavily involved in substation projects.

ABB also makes it easy and fast to order the PS-1. By using the configurator Internet tool, customers can select variables and specify an order. Detailed drawings are immediately generated according to customer specifications.

Effective electrical insulation techniques, like in this valve assembly, also help reduce the size of substations and transformers.

Solid insulation is a principle applied in ABB's new cable type of transformers. BC Hydro in Vancouver, Canada has ordered two of ABB's new generation power transformers which eliminate the need for insulation oil.

Now you see it, now you don't

Distribution transformers are a bulky eyesore around millions of North American homes. Mounted on a pole or sitting on a pad, they represent "ancient" technology from the early days of electrification.

ABB and Hydro-Québec, the big Canadian utility, recognized the need to design a completely new transformer which would address and resolve all electrical and environmental issues. The two companies formed CITEQ, a joint venture business, to develop the revolutionary Solid Insulation Distribution Transformer (SIDT). The SIDT is now on trial at some 300 locations across North America, exposed to a range of climatic and operational conditions. The new design is also suitable for European three-phase operation.

The SIDT is designed to meet the requirements of local infrastructure planning, and eliminate unsightly above-ground structures. It is installed underground even in land subject to chemical flows, including fertilizers, places where ordinary steel transformers cannot operate. Some are even operating underwater to demonstrate their integrity and safety. The SIDT offers significant improvements in performance and reliability over conventional distribution transformers.

It features a unique solid epoxy insulation system and a composite-material outer shell. The geometry of the windings is also completely different. The solid, epoxy-based dielectric medium replaces oil, totally impregnating the windings and coating the magnetic core. A composite/vinylester outer shell replaces the traditional, oil-filled steel tank transformer. The composite shell is waterproof, resists even salt-water corrosion and requires no maintenance.

Smaller than conventional transformers, the SIDT also functions more efficiently with lower electrical losses. It has a 30-year life expectancy, and operates in the 25 to 167-kilovolt amperes range, which is standard for distribution and local electrical networks.

Enjoy the view

With annual global car and truck production at around 50 million units, windshield assembly is a precision, mass-production business with the added complication of fragility.

ABB's new compact assembling system is faster and more efficient than manual assembly, with fewer breakages, lower labor costs and increased output.

A typical windshield is comprised of two very thin glass panes, each no more than 1.2 mm thick, with a Polyvinyl Butrayl (PVB) sheet sandwiched between them. The high-speed, precision process creating this glass sandwich happens in a temperature and humidity-controlled environment where the glass panes cannot be marked or scratched.

ABB's new compact assembling system produces up to five windshields per minute, combining speed with efficiency and reduced costs. Skilled human assemblers might match that kind of performance, but only for a short time.

The engineering autopilot

Each day, ABB books US$ 25 million in automation orders, ships some 600,000 automation products and visits 3,000 automation customers. ABB motors, drives, robots and power systems run more plants than those of any similar supplier. ABB is developing a new generation of automation products and systems that will enable industries to produce with maximum efficiency, versatility and with minimal environmental impact.

Market characteristics

ABB has a strong position in the global automation market: first in electrical machines, first in drives and power electronics, second in low-voltage products, second in instrumentation, second in controls and a close second in robotics.

ABB's customers operate sophisticated plants. Discrete manufacturers like carmakers, or process producers like pulp and paper makers, must have the most reliable equipment and control systems. The quality of their products is their competitive edge, and it is ABB's job to deliver the products and systems to help them keep that edge.

In addition to reliable, high quality products, ABB's customers need to increase efficiency and find better solutions for supply chain management.

The challenge of automation goes beyond individual products. It has to respond to customer needs like supply chain management and inventory control at the same time.

Technology areas

Customers want their products, systems, solutions and services to be smarter. This allows them to get much more real-time information, when and where it is needed. Asset optimization lets them monitor, analyze, schedule, control and improve the performance of their production assets, and also extend the life of those assets.

Industrial IT helps them do this, and to interact and collaborate with their own customers and suppliers in real-time. ABB is creating better types of process control and tools for optimization, enabled by a powerful software architecture. On a component level, the critical areas of focus are Micro-Electro Mechanical Systems (MEMS) and sensors, as well as power electronics. Linking components and systems with wireless communication is a technical opportunity, as is the intelligent combination of control and mechanical movement in advanced robotics systems.

Research programs

The global automation research and development laboratory works with some of the world's most respected universities. MEMS systems are being developed and wireless communication is being added to many industrial products. Software development and quality are two major R&D programs.

Industrial IT

Automation technology is the focal point of Industrial IT, ABB's real-time information architecture that links separate products and services with software for fast information retrieval. Industrial IT lets ABB's products and services work seamlessly together through efficient exchange of information. New products, like Field IT for fieldbuses, and Drive IT for drives, link customer systems seamlessly and offer "plug-and-produce" ease of operation.

600,000 products a day

Did you know? ABB ships 600,000 automation technology products a day. US$ 200 million worth was ordered on the Internet, either via www.abb.com or external channel partners' Web sites, last year.

ABB's software packages control the flow of everything from cement, gold and nickel to diamonds, pulp and paper, and pharmaceuticals – as seen here.

ABB is convinced this way of managing information will become the industry standard. ABB develops customized systems for many markets and is aggressively leveraging the advantages of the automation platform. For the pharmaceutical industry, Industrial IT helps produce a range of products, applications and services that speed up delivery and regulatory approval.

On factory production lines around the world, Industrial IT helps ABB robots galvanize, weld, paint and assemble all types of products faster than ever before. Industrial IT has proven very helpful to the petroleum and petrochemical industries, and the pulp and paper industry.

Strategic initiatives

The ongoing Industrial IT certification of all automation technology products and systems is a key initiative going forward. In addition, ABB is working to launch more pilot studies in as yet untapped areas like the automation of power plants, oil platforms and electricity grids.

The customer's voice

In Mexico, state-owned oil company Pemex has started a modernization program to revamp all six of its refineries. ABB has recently completed work on the first refinery in Minatitlan on the Mexican Gulf – one of the largest integrated control and instrumentation installations ever undertaken in the refining industry.

Says Mario Castillo, an operator at the facility: "With the ABB Operate IT stations, it is easier to control the process. I can see the total system on one screen. In two clicks everything can be adjusted to make a better product."

The solution is based on ABB's Industrial IT platform for seamlessly linking multiple applications and systems in real-time. The immediate benefits to Pemex are significant productivity improvements and cost savings. Safety and emergency response times have also improved dramatically, while requests for maintenance have been cut by at least 60 percent.

Outlook

The future of automation R&D will be guided by customer demand and ABB's Industrial IT vision – a single information architecture which enables all of ABB's products and systems to work together across the business enterprise. It will include data integration from device to enterprise level, as well as advanced process modeling for plant control and asset optimization.

ABB drives control the speed of paper lines in countries like China, Sweden, Finland and Canada, ensuring readers get top-quality newspapers and magazines.

Milled to perfection

Pulp and paper mills are sophisticated operations vulnerable to production losses, quality deviations and excess chemical and energy consumption.

ABB's new online pulp and paper production optimizer is an Industrial IT application designed to optimize efficiency in the industry. A major trial is in progress at Billerud's Gruvön Mill in Sweden, which produces some 600,000 tons of paper annually from six paper machines and three fiber lines.

ABB's optimizer works as a bridge linking the mill's components with an open software architecture called the Aspect Integrator Platform (AIP).

Real-time data collected from many different places, including the digester, bleach plant, storage tanks, chemical cycle and evaporator plant, is combined with capacity constraints and planned maintenance schedules to create a total process picture.

Initial results from the trial suggest an increase in paper production of more than two percent, savings in chemical consumption in excess of ten percent, and associated improvements in production control and machine utilization.

The test is on a commercial scale and is an important means of increasing paper mill productivity.

Information profiles are integrated to wring optimal use from each mill component, and to enhance performance in areas like chemical balance and raw material usage, energy management and overall production levels.

The optimizer assesses the status of key elements like production rates, buffer tank levels, laboratory data, capacity constraints and scheduled maintenance. It then predicts the dynamic behavior of the mill, and proposes suitable courses of action to optimize cost-effective production.

ABB worked with several partners to develop a more powerful fieldbus, which is used in the control systems of water and waste plants around the world. Here, the control room of a sewage water pump station in Emmen, Netherlands.

Fielding all information

ABB is a leading manufacturer of instrumentation for automation and control systems. ABB instruments measure many variables, including temperature, pressure, flow, level and pH in water and waste plants, on oil platforms and even as oil is pumped from the bottom of oceans.

Digital data communication has vastly increased the power and effectiveness of such instruments, connecting and linking their data to a central control using a fieldbus.

ABB has boosted the power of the traditional fieldbus with a unique Field Device Tool (FDT), which lets users integrate information from essential areas like engineering, diagnosis, service and asset management.

Instead of connecting each and every instrument individually to the control station the fieldbus connects them all at the same time with only one line. The digital information is then coded to identify the specific instrument.

A digital signal carries many separate pieces of data, and allows the instruments to input far more data than before, including device configuration and maintenance status. Digital instrumentation using fieldbuses can deliver large amounts of collected data, and deliver substantial installation, operating and maintenance savings.

Different types of information, which in a plant may come from the instruments of different suppliers, cannot easily be connected and processed. ABB cracked this problem by developing an engineering interface that is universal, irrespective of supplier. The technology leap allows users to integrate devices from various manufacturers into their automation systems. This is a major step forward in plant management because engineers no longer need to learn different configurations for each device supplier.

Spot welding and painting have dominated the application of robots to industry. ABB is working with manufacturers to create Industrial IT solutions which will prevent costly downtime: visit www.abb.com/robots.

Painting by numbers

Downtime is bad news at any manufacturing plant. If a line stops, for whatever reason, output and efficiency are affected and the company's financial performance suffers.

In the automotive industry, paint line stoppages are particularly costly because they often create quality problems.

ABB is working with Volvo on a paint line trial to reduce downtime by using Industrial IT to integrate maintenance information and performance data from general manufacturing and control systems.

The Volvo plant uses a number of different control systems for the paint line. Maximo is a system developed by MRO Software to handle maintenance, but separate systems drive the line and the robots that manipulate car bodies moving down the line.

Industrial IT integrates information from all the different systems in the paint line and delivers significantly improved fault detection and maintenance data.

The hard part is identifying the cause of a breakdown: human error or equipment failure? After the root cause is identified, corrective maintenance can begin. That means deciding what to do, ordering the maintenance work, spare parts and tools, and carrying out the repairs.

Armed with the right information at the right time, maintenance staff can react more quickly or even intervene to eliminate faults before the line is stopped.

ABB's pocket portal software can be uploaded to any portable desktop assistant, allowing plant managers to roam the factory floor and maintain an overview of operations.

The wireless way

ABB has developed a wireless pocket portal that allows plant operators to roam the factory floor and still be connected to operational data and controls.

The absence of wires lowers manufacturing and engineering costs, allows for simpler components, and means system users are no longer tied to fixed points.

In many factories, machinery and processes are managed from a central control room. Operators leaving the control room must return as fast as possible to deal with an emergency, and any delay could damage the plant.

With ABB's wireless pocket portal hand-held display, an operator is free to roam the plant without ever losing access to control room information and controls. In an emergency, this means an operator retains full access to control data and Intranet connections while outside the control room.

ABB's wireless pocket portal can even send a verbal alarm message describing the problem. Plant safety is enhanced and operator control maintained at all times because necessary data is instantly available.

The principle of wireless technology can be used in many industrial applications, including power supply from a transmitter rather than a fixed link.

A typical application is industrial robots. Ordinary sensors are often attached to the gripper and other fixed and moving parts, but connecting cables from the base of the robot to the gripper frequently wear out and must be replaced.

ABB solved this problem by designing a wireless sensor. It transfers information about its local position and draws power from a localized, transmitted, wireless source.

Sensors that measure the distance to an object are called proximity sensors.

They have thousands of industrial applications. More than 60 percent of sensors used in production machinery are proximity sensors that have been wired into place. A wireless proximity sensor consumes less than one percent of the power needed by these conventional wired sensors.

Wireless sensors can be used wherever proximity sensors are commonplace, particularly paper mills, car plants and steel works.

Power play

ABB sells more than one million electric motors every year, offering customers a wide range of applications and operating voltages. Now ABB is able to supply motors with very high operating voltage above 20,000 volts.

Very High Voltage (VHV) motors are particularly useful where space and access is limited, and efficiency is a major issue. Customers in the chemical and petrochemical industries, as well as builders of oil production platforms, are showing particular interest.

VHV technology simplifies system layout by eliminating the transformer and related medium-voltage switchgear, reducing the cost of service, maintenance and spares.

The key enabling technology for this breakthrough is in the design of the cabling used to wind the motor, which allows windings to handle up to 150 kilovolts.

Conventional motors operate at up to 15 kilovolts, while the voltage of the supply grid is usually higher. Transformers and switchgear are necessary to reduce the grid voltage to the motor's operating level.

ABB's new VHV motor can take grid voltage directly, creating higher operating efficiencies and eliminating the need for transformers, switchgear and other control equipment.

ABB is at the forefront of the new cable design and insulation technology for VHV motor applications. Customer installations have been operating extremely well for more than a year, demonstrating the value of this new concept.

The high-voltage motor uses new technology based on ABB's patented high-voltage cable winding concept to make motor installation simpler, more efficient and more environmentally friendly in system components like transformers and generators.

M-Real, one of the world's most advanced suppliers of paper and paperboard for use in magazines like the Economist, Time, Cosmo and Elle, set a world speed record for printing paper: 1,804 meters per minute over a 24 hour period, using ABB's drives.

Lean and mean

ABB's latest innovation for the paper industry is a Direct Drive electric motor which operates without a gearbox, at low cost, with high reliability. It is based on a unique and simple design.

Conventional drives operate as fast as 1,800 revolutions per minute, too fast for paper machines which run at up to 500 revolutions per minute and need gearboxes to reduce speed.

ABB's new Direct Drive operates at lower revolutions per minute, yet delivers the same power with substantially higher torque than conventional motors, eliminating the need for a speed-reducing gearbox.

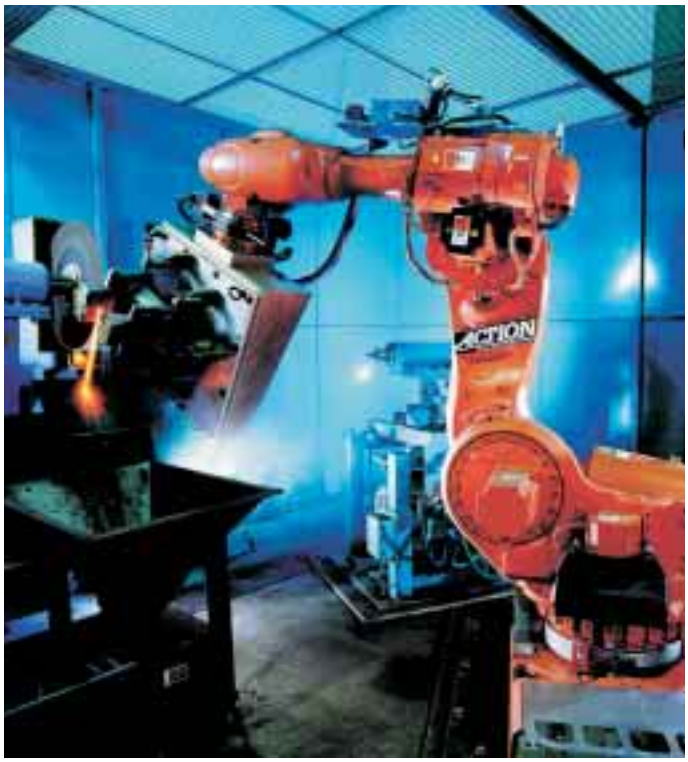
ABB delivers close to 2,000 drives to 100 paper industry projects annually, and about 400 could easily be replaced with Direct Drives. The drive control system, application software and man-machine controls are similar for all ABB paper machine drive solutions.

The new Direct Drive technology, with its compact size, makes better and more efficient use of factory floor space and allows easier access, for fast maintenance and repair work.

With fewer components and a simpler configuration, the Direct Drive can be installed quickly and reduces plant engineering hours.

Direct Drives can be used as replacement upgrades without changing the control system. They can be used in parallel with other ABB drive solutions and old converters can easily be upgraded to the new Direct Drive.

As paper machines have to operate at controlled speed within very tight limits, the Direct Drive accurately measures motor speed itself and compares it to the required value, safeguarding costly paper production.



Power robots are needed for heavy lifting in processes ranging from making steel to bottling beer and champagne. ABB's new line of power robots brings clockwork precision to these tough tasks.

Heavy metal

ABB sells about 10,000 robots annually, and by now they are a familiar sight in factories and workshops around the world.

Most industrial robots are designed to lift up to 250 kilograms, including the robot arm and gripper (the hand of the robot). These units are in high demand and good for most applications, but robots are also needed to handle heavier payloads.

ABB has expanded its family of industrial robots with a new Power Robot range, for heavyweight challenges in the 500 kg range.

Strong, accurate and flexible, ABB's new Power Robot brings automation to new areas, such as handling ferrous castings or heavy crankshafts.

There are many applications for heavy-duty robots. In the auto industry, a car body weighing up to 300 kg must be lifted off an assembly line conveyor. With the robot gripper and tooling, the total lift payload is nearly 500 kg.

Power Robots can be used in foundries to hold heavy metal parts during grinding or polishing, when accuracy and stability are vital. Breweries and wineries also need powerful robots for careful, heavy lifting.

Building a robot to lift heavy items presents new technical and control challenges. Great weight must be lifted close to the robot's center of gravity, ensuring accurate movement and eliminating swing when in motion. The robot itself must be compact enough to work in confined spaces. The new active braking system, which ensures the robot stops along its programmed path even in an emergency is a safety feature particularly important given the heavy payloads and movement involved.

ABB has researchers developing software programs that mirror the workings of a human mind and body. Applying this flexibility to robotics helped the company develop a new software program – part of the Robotics IT portfolio – for picking up, aligning and bending sheet metal into car parts and metal cabinets more efficiently and precisely than before.

The wizard without flaws

When you install a new application on your PC, you normally use a software wizard. Just answer some basic questions, and the wizard does the rest automatically.

ABB now offers customers that kind of programming convenience with BendWizard, computer software which can quickly and efficiently reprogram press brake robots. Press brakes are machines that bend sheet metal, and are a common sight in thousands of factories.

Introduced two years ago, BendWizard is selling worldwide to press brake manufacturers and users. Three of the largest press brake producers already use the product, which can be installed in old machines as a retrofit.

Increasingly, robots are used to pick up, align and bend metal sheets into required shapes. But programming a robot for a typical press brake application like making metal cabinets can be a complex and costly operation, and this limits automation to high-volume production alone.

ABB developed BendWizard to provide a rapid, simple off-line process giving metal fabricators the cost benefits of advanced automation in small and large-batch runs, adding real value to their operations. By dramatically reducing robot downtime and making production runs for fewer than 50 pieces economically viable, BendWizard offers smaller workshops a genuine incentive to invest in modern automation systems.

Podded propulsion

More than 100 of ABB's Azipod podded propulsion units have been installed in the past decade. They incorporate a direct drive propulsion system in a hydrodynamically efficient pod, which rotates when the ship's wheel is turned, eliminating the need for a rudder.

The latest extension of the Azipod family is the Contra Rotating Azipod Propulsion (CRP) unit, which extends the concept to high power applications like ultra-large container vessels and ferries crossing the Baltic Sea and English Channel.

Tests show propulsion efficiency is up to 15 percent higher than conventional diesel propulsion. A CRP unit offers excellent performance and maneuvering capability, shorter and safer harbor times, reduced fuel consumption and safer operation, especially in harsh weather conditions and restricted passages.

The Azipod name comes from the pod's azimuthing ability to rotate a full 360° without restriction – the Azipod propulsion system.

The CRP unit has two separate propulsion shafts, which operate propellers that face each other but rotate in opposite directions. One shaft is fixed and drives a four bladed propeller, which provides typically 50 to 70 percent of the motive power; the other is a five bladed propeller in an Azipod, which is also used to steer. One propeller makes the water move while the other works against the rotating flow to recover rotational energy from the forward propeller.

Professional tools for perfect service

ABB is working to improve engineering efficiency by researching and developing a number of unique software programs and system processes.

This research area is not always tangible because it does not necessarily involve concrete products. Rather, engineering processes are broken down into fundamental parts and rebuilt in streamlined, coherent ways to save money.

Online ordering is a staple of the consumer industry: when you want to buy a book you visit a Web site, surf and place an order. ABB is applying the same principle to its products and services. Now you can visit www.abb.com and place an order for anything from switchgear to substations and transformers.

Market characteristics

More than 50 years ago, 100,000 workers at Ford's River Rouge automobile plant turned out 1,200 cars per day. Today, Ford's plant on the same site produces 800 cars a day – with only 3,000 workers.

Every industry is aiming for similar efficiency gains. ABB's customers today are building or improving their power plants and factories in a modular way – based on a template that is duplicated in many locations around the world.

Another fundamental shift involves information technology. In the past, a supplier like ABB produced many products locally. Information about those products or a given system was needed at the source. Now, customers want an overview of all their subsidiaries. Products and their applications must be monitored from anywhere in world, which means processes powered by robust information technology and infrastructure.

Technology areas

ABB is developing new Web-based software solutions to improve engineering, manufacturing and service processes. Using new approaches in knowledge management allows ABB to deliver critical information directly where it is most needed. Agile manufacturing, developed together with members of the Massachusetts Institute of Technology Leaders for Manufacturing program, is being introduced in ABB factories worldwide.

Research programs

The manufacturing technologies research program works to improve information and material flow across the production value chain. The research team works to improve the flow and quality of product information throughout the development phase and during service.

40,000 online documents

Did you know? ABB's Solutions Bank has more than 40,000 troubleshooting documents and is used by more than 4,000 customers.

Control boards rolling off a line at an ABB factory are one step in the manufacturing process. ABB's Industrial IT platform lets a customer develop advanced supply chain management processes by optimizing everything from ordering to manufacturing and delivery.

Industrial IT

Manufacturers face one main challenge in the years to come: integrating business systems like SAP or Oracle used to manage an operation with the products and services doing the work on the shop floor. ABB's Industrial IT platform allows a customer to integrate business and manufacturing information systems between geographically distant factories. It also allows a customer to develop advanced supply chain management processes by optimizing everything from ordering to manufacturing and delivery. Every part of the supply chain, from supplier to customer and buyer, can glean information needed to increase productivity, efficiency and competitiveness.

Strategic initiatives

Alongside the application of ABB's Industrial IT concept for engineering and manufacturing, the company is working to develop an advanced supply chain management system and specific execution applications.

An initiative is also underway to integrate multiple lower-level manufacturing/quality information systems in factories, which are often overlooked.

The customer's voice

Simply amazing – that is how the technical manager of Welsh ship-owners Graig Ship Management describes ABB's response to a problem the company faced on the other side of the world.

The particular case involved a bearing failure on a turbocharger aboard one of Graig's cargo vessels, the CEC Westoe.

"We already knew that ABB delivered excellent service," says Graig's Rob Cotter, "but this particular case was simply amazing. I would never have thought it possible. ABB first heard about the problem on Friday, but by Sunday they had built a new rotor assembly, shipped it halfway around the world and installed it. ABB was absolutely fantastic."

Outlook

Computer Integrated Manufacturing (CIM), the process approach of the 1980s, lagged mainly because the technology and architecture necessary to cope with many different machines and applications were missing. ABB's Industrial IT architecture, with its key Aspect Integrator Platform (AIP) technology, makes the CIM vision a reality.

Being able to configure a complex product like a distribution transformer online may sound unrealistic, but it really isn't. To configure your own power technology product, visit www.abb.com/compactswitchgear.

Surfing for solutions

Internet users have for some time now been able to order books online with a simple mouse click. It's as easy as picking an item out of a catalog.

But suppose you want a book that is only similar to one in the catalog? What if you want the story to end in a different way? What if you want a customized version?

With this in mind, ABB found a way for customers to customize their online orders.

Say you need an instrument transformer – a meter that can measure voltage or current in an electric grid. It must fit exact specifications, and even though it isn't exactly like the meter in the product catalog, you need it right away.

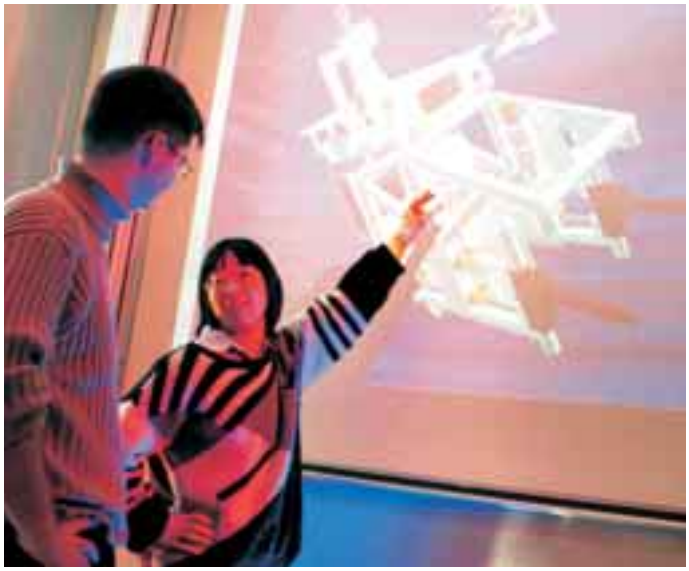
To meet demands like this, ABB created an engineering system that turns online orders into product solutions quickly.

The system's product design process works on electrical and physical parameters that are based on the vast experience of ABB engineers.

It's a front-end engineering system that can handle tens of thousands of custom orders online each year. ABB's goal is to process customer orders within 15 minutes of receiving them, and begin production within two hours of receiving the order.

The goal of delivering a finished product within six working days of the order is possible with streamlined order information and material flows across the business.

Engineering software lets customers write their own "stories," and introduces customized online ordering with the click of a mouse.



RiBA (Risk Based Assessment), an ABB-developed software, helps companies plan large-scale projects and measure probable risks in Brazil, Spain or China – anywhere in the world.

Mass production made easy

Standardizing processes and products is a key element of industrial production. Serving customers with a single type of product, manufactured in large quantities, is the most cost-efficient way of manufacturing.

As special customer orders and tailored requests come in, the product range broadens and companies begin to deviate from this cost-efficient approach.

For example, ABB robots come with more than 200 options, including five input/output interfaces. These interfaces depend on the robot's application, which could be anything from welding to painting or assembly.

ABB customers appreciate the many options, which is one reason ABB is the world's leading supplier of robots, selling 10,000 units per year.

Supplying a broad application range with only a few standardized components is a major challenge, but the savings involved encourage serious research.

ABB has worked with the Massachusetts Institute of Technology since 2000 to develop a software tool to analyze the link between products and customers, and identify ways to perfect product ranges.

This approach requires careful analysis of customer needs, and product design based on modules that can be combined into various applications.

A successful product redesign has many benefits. Customers get higher quality products which exactly match their requirements, and are able to order them more easily. ABB can increase sales and drive manufacturing cost down.

The ABB/MIT research has identified several areas where significant improvements can be made. For example, new findings indicate that the number of input/output options in robot controller applications could be reduced by 70 percent.

Risky business

When ABB has to deliver a complete plant in a challenging environment involving hundreds of sub-suppliers, on-time delivery is crucial. Late deliveries translate into project losses and cost overruns; early deliveries mean increased bonuses and faster production.

Because each project and location is different, customer requests don't follow a pattern. A substation in Brazil could involve 20 sub-suppliers, while a similar substation in China could involve 100. All must be seamlessly integrated into the project.

To deal with challenges like this, ABB has developed the Risk Based Assessment (RiBA) software tool – an analytic device that can evaluate project risk.

RiBA software outlines the scope of a project, then adds an uncertainty judgement to each task by estimating the probability of events like on-time or early delivery. To do this, the software is able to make subjective judgements based on past experience. Each entry has a reliability profile, especially where subcontractors are involved or there are circumstances outside the contractor's control, such as vulnerability to weather or a long logistics chain.

By modeling these elements and sampling different scenarios, a simulation is made. The resulting data shows the probability of completing a project within a delivery time range.

RiBA analysis shows how to handle workflow bottlenecks, the necessary terms and conditions needed with sub-suppliers, and what effect these may have on the overall cost of project completion.

When something goes wrong on the shop floor, like a broken machine or a jammed computer, out comes the dusty user manual. Many hours later, the problem is solved and production can begin again. ABB's Solutions Bank Web site (www.solutionsbank.abb.com) helps operators troubleshoot online quickly and easily from a checklist of 40,000 possible problems and solutions.

Just say know

Excellent service depends on good knowledge of the machine in question – when was it last maintained, and by whom? What new components have been installed and when? When should a motor be serviced? What are the failure statistics for specific motor applications?

Take the example of International Paper, the U.S. paper manufacturer. To keep a sophisticated paper-making line constantly working, the machinery must be serviced in an organized way.

ABB recently installed a new Industrial IT module – the Support IT Knowledge Connect – in a customer's factory in Mississippi.

This software directly connects the service engineer or the plant operator with a huge depository of information about the control system in the plant. As a major supplier of automation systems to pulp and paper customers around the world, ABB is able to draw on a knowledge pool that consists of about 40,000 documents and is currently used by more than 4,000 customers worldwide. The knowledge pool helps customers make the right decisions for service, maintenance, repair or inspection.

Support IT Knowledge Connect also offers a direct link to ABB's 24 hour expert service, where customers can go for further help.

Breaking the mold

Electrical components are almost always encased in plastic insulation. Sophisticated technology stands behind the manufacture of these common plastic molds. The integrity of the molding depends on the proper manufacturing process, but plastic molding and manufacturing has always been a somewhat inexact science, relying on "hands on" experience and trial-and-error.

ABB has developed a unique, 3-D computer modeling technique that raises the efficiency of reactive molding that is used to apply insulation plastic around medium and high-voltage products.

ABB's distribution transformer factory in Łódź, Poland produces about 6,000 units annually. To improve performance, ABB engineers injected a healthy dose of Industrial IT, which allows orders to be processed in hours rather than days.

ABB's 3-D computer simulation provides information to identify what happens during the critical molding and gelation process. This data can be applied to the design of the mold itself, and also specify optimum values for key variables like resin temperature, injection pressure, mold temperature scheme, position of inlet channels and the initial temperature of internal parts.

This helps overcome common problems, such as premature gelation, undesired weld-lines and air traps.

With the 3-D computer model, mold design and development which once took about two years has been shortened by 25 percent. The goal is to reduce by 30 percent the time needed to design the whole product.

The 3-D tool will be refined to simulate chemical shrinkage and thermal stress.

The need for speed

ABB produces about 6,000 distribution transformers annually at its factory in Łódź, Poland, in sizes ranging from 251 to 2,000-kilovolt amperes. Each one is a precision bundle of metallic-core materials, copper winding and insulation, encased in an oil-filled housing.

With the plant operating at full capacity and a growing order book, the lead-time for customer quotations and the manufacturing cycle are critical success factors.

To boost the performance of this factory, ABB installed a full-fledged Industrial IT system, blending customer order inputs with factory floor operations, linking enterprise resource planning and supporting systems with ABB's partners.

Industrial IT integrates and manages the information in real-time so everyone knows what is happening in the plant, as well as in the order and delivery books.

Today, customer quotations with unique specifications, raw materials and accessories are generated electronically. This launches a rapid search for matching or "best fit" characteristics across the complete database of ABB transformer designs, linked to some 30 sites worldwide.

Once a match is found, a delivery date based on material availability and capacity is defined. Armed with this technical and production information, the system automatically generates an offer – reducing to minutes a process which once required hours or even days.

When the customer accepts the offer, order details are transmitted to the factory and handled by the enterprise resource planning system. Each new order is automatically planned and scheduled based on delivery date and plant capacity. Material requirements are verified, and any purchase requisitions automatically generated.

In addition to streamlining planning and control functions, customers can be advised of the progress of their order at any time, including information on job status, quality and test results, as well as historical performance information – all with a simple mouse click.

Clean machines

The world consumes one billion gallons of gasoline every day.

Pressure for stricter environmental controls to reduce harmful emissions means that refiners are continuously challenged to produce high quality, clean motor fuels.

ABB, in partnership with Akzo Nobel, has developed a new, environmentally superior process for making alkylate, the key ingredient in gasoline, which also offers lower maintenance and safer production.

One of the key advantages of ABB and Akzo Nobel's technology is the use of a solid acid catalyst. It is environmentally benign and eliminates the risks associated with liquid acids. The alkylate from this new process is similar in quality and cost to its predecessor.

The new technology couples the solid acid catalyst with a novel alkylation reaction system. As a result, there is no potential migration or leaching of corrosive acid from the catalyst system.

It also eliminates the production of a heavy oil by-product called acid soluble oil, an unwanted feature of conventional liquid acid catalysts that can be difficult to recover and dispose of.

There are more than 700 refineries around the world with about 170 alkylation units, mainly in North America. As the need for ultra clean gasoline increases and old alkylation systems are retired, there is clear demand for this new process.

Deeper, faster, cleaner

Oil and gas exploration and production is moving beyond the imagination – into deeper waters and ever more remote and desolate fields. These often harsh environments demand robust technology and unparalleled planning tools. When crude oil makes its way to production, it must be processed efficiently and take into account the environment.

Market characteristics

The global oil and gas industry is super-competitive; the giants have undergone a wave of mergers and the ensuing battle for new fields is fierce. Capital expenditures are down, which means the industry is looking for more optimization technologies to improve existing production sites.

ABB recently signed a contract worth US$ 987 million with Exxon Neftegas Limited to develop onshore oil and gas processing and well-site support facilities on Russia's Sakhalin Island, in the Sea of Okhotsk.

Technology areas

The global research and development laboratory for oil and gas technologies brings together high level and wide ranging expertise to develop high-tech, cost-efficient solutions for the optimal recovery and processing of oil, gas and petrochemical resources.

Research programs

ABB has two global research programs supporting these technology areas. The upstream oil and gas technologies program is focused on the next generation solution for deepwater field developments. Focused technology areas are floating platforms, subsea production systems, risers, compact processing for subsea and topside applications, reservoir monitoring and remote control. The catalysis and chemical processes research program works on advanced reaction and separation systems for the refinery and petrochemical industry. Focus areas are advanced catalysis, clean fuels and next generation olefins technology.

Industrial IT

The Oilfield of the Future (Smart Assets) will be operated as a single industrial process, optimizing oil and gas production from the reservoir through the wells and surface facilities, and in integration with the operators' enterprise management model. To get to this point, vendors will be asked to provide new software, equipment and services to supply integrated process control in combination with optimized asset management.

ABB is in a unique position to take a leading role in the development of total systems solutions, offering enhanced productivity and lower cost, as well as new work processes for the industry that allow for better use of human resources.

2,777 meters deep

Did you know? The Brazilian oil company Petrobras set a world record in deepwater drilling of 2,777 meters (9,160 feet) using ABB technology.

The offshore oil and gas industry is increasingly moving equipment from the ocean surface to the seabed. There are a number of reasons for this, including environmental and cost considerations. In 2002, ABB won several large orders with Statoil and Norsk Hydro, among others, confirming the importance of research carried out in close cooperation with customers.

Strategic initiatives

In the upstream side of the business, ABB's strategy is to develop and maintain leading positions in subsea production systems; deep-water floaters for all environments and payload requirements; compact and efficient processing systems for subsea and topside applications; and pressure-containing equipment for demanding environments, from ultra-deep subsea to remote desert locations. On the downstream side ABB is working to support customers with advanced technology solutions that allow them to produce clean transportation fuels, chemicals and polymers in facilities that use advanced catalysts, equipment and processes, to minimize capital, operating costs and environmental impact.

The customer's voice

"It's not about selling more to us, it's about creating value."

Norsk Hydro, one of ABB's biggest customers, says that value creation is a key factor when choosing the companies it will do business with.

"Cost is important, but we are looking for suppliers who think and behave like we do, and who are committed to creating value for us and themselves," said Terje Ingdahl, head of sourcing equipment and material at Norsk Hydro.

Having taken all these issues into consideration, Norsk Hydro chose ABB. "So far, we haven't been disappointed," said Ingdahl.

Outlook

ABB will intensify its technology partnerships with selected key customers. This is to ensure that new products and systems are fully aligned with client needs and requirements. A very important part of such relationships is the availability of relevant sites for pilot testing of new technology.

In addition, ABB will continue to cooperate with leading universities within relevant areas of technology. This ensures ABB is on the cutting edge of technology, can recruit fresh talent, and gets good value for money in research.

Oil and gas technologies

ABB is the world leader in ethylene technology, with around 40 percent market share. Ethylene production has certain undesirable by-products that are eliminated by conversion to olefins. Where this was once done with four reactor systems, ABB combined the process into one, eliminating about 40 pieces of equipment.

Go deep

ABB has developed a new technology that reduces the time it takes to reach first oil, the industry term for a well that starts producing oil and earning revenue. It's the critical measure for customers, who only earn a return on their investment once oil flows.

This new technology – which also increases reliability and availability – is called NuDeep, a patented ultra deep-water subsea processing system, which offers customers several significant advances in technology and operating efficiency.

Oil production in ultra-deep water, down to 3,000 meters, is extremely difficult and expensive. Significant amounts of water are mixed with oil in subsea reservoirs. Traditionally in deep-sea operations, water is only separated and discarded when it reaches the surface platform. This is inefficient because it reduces oil flow and increases the cost of lifting the mixture to the surface.

NuDeep is a modular system. New wellhead design and Christmas tree (an arrangement of pipes, valves and automated controls that regulate the flow of oil at the wellhead) systems make it possible to handle intense pressure barriers. NuDeep is easy to install and environmentally sound, meeting all safety regulations. And remote intervention is significantly cheaper and safer than today's recovery systems.

As the total cost of a subsea oil and gas development directly relates to the capital cost of equipment and the operation and maintenance of the well itself, NuDeep can significantly reduce costs over a system's lifecycle. Concentrating more functionality on the seabed and simplifying traditional designs is a paradigm shift in subsea production, which is now possible with ABB's new design.

Licensed to save money

ABB has developed revolutionary design changes in olefins processing technology that will improve project economics by up to 30 percent.

By changing process chemistry and reconfiguring the way olefins are recovered, equipment requirements will be reduced by as much as 25 percent, greenhouse gas emissions and energy consumption will be cut by up to 12 percent and investment costs will drop by 15 percent.

Olefins production is a major part of the global petrochemical industry. Olefin polymers are made by chemical reactions involving propylene and ethylene, and are used in apparel, home furnishings, automotive and industrial products. More than 105 million tons of ethylene and 45 million tons of propylene are produced worldwide each year.

More than 300 ethylene plants are now operating, and each year about six new plants are commissioned, each costing between US$ 400 million and US$ 800 million. ABB licenses the technology and provides engineering, procurement and construction services for these plants, primarily on a turnkey basis.

On the engineering side, ABB has redesigned the reactor which takes raw hydrocarbon feedstock and breaks the molecules apart. Using computational fluid dynamics, ABB's new reactor is 15 percent smaller than before, but handles the same capacity.

A second engineering advance is in the compression/separation area, where four compression systems have been reduced to two. The main gas compressor now operates at 15 atmospheres of pressure instead of 40 atmospheres and three refrigeration compression systems have been combined into one.

The net result is a 40 percent reduction in the number of compressors and turbines needed, from ten to six.

An ABB engineer tests and verifies borehole instrumentation strings in the Yibal oil and gas field – courtesy of PDO and the Oman Ministry of Oil and Gas.

ABB has changed the process chemistry by using a chemical reaction instead of high energy refrigeration to remove hydrogen.

Ethylene production has certain undesirable by-products that are eliminated by conversion to olefins. Conventionally, this is accomplished using four separate reactor systems, but ABB has combined the process into a single reactor, eliminating about 40 pieces of equipment and saving energy while also removing 35 percent of the hydrogen in the gas without refrigeration.

A second ABB chemical advance converts "orphan" by-products that are valuable as fuel into ethylene, propylene or hexene 1, which can be sold for up to US$ 1,000 per ton – a five-fold increase in value.

ABB is the world leader in ethylene technology, with around a 40 percent market share. Realizing some time ago that China is expected to show the largest growth in olefin consumption in the coming years, the company formed a partnership with Sinopec, its leading petrochemical producer. The two companies are jointly working to commercialize the new olefin technology through several demonstration plants.

Listening to the sounds of silence

Earthquakes registering over six on the Richter scale can be highly destructive.

Yet micro-earthquakes – less than one ten-billionth the strength of a major quake and undetectable on the earth's surface – can offer valuable information on the structure and performance of oil and gas fields.

ABB can install micro-sensors down boreholes to detect and measure micro-earthquakes, producing seismic data which shows where pressure and stress is concentrated, and how they change over the life of a reservoir. The data can also identify areas in a reservoir that can deliver – or not deliver – oil and/or gas.

A network of seismic sensors is created at various depths within several boreholes. The sensors listen to the reservoir and detect microseismic events induced by pressure and stress changes. The location of the micro-earthquakes and the type of signal indicate how the reservoir is operating.

The PDO's (Petroleum Development Oman) Yibal oil and gas field is the site of the first, large-scale, high-resolution, multi-borehole and multi-sensor micro-earthquake monitoring project in an operating oil and gas field. This collaboration between PDO, Shell and ABB is focused on how to use and interpret the high quality micro-seismic data taken from the reservoir.

Hydrocarbon reservoirs are often divided by geological faults into small sections. This can produce reservoir "compartments" that are not hydraulically linked – so a well drilled into one compartment will not produce any hydrocarbons from a neighboring compartment. Oil recovery from most reservoirs is around 35 percent of total reserves, and large sections of the field are unproductive.

ABB's monitoring technique can identify where these faults are, and indicate barriers to hydrocarbon production. This information can be critical in the planning of new wells.

The micro-seismic technique is new to the oil and gas industry. The project brings together existing and innovative technologies in a new environment. The outcome will be new reservoir information, data processing techniques and computer simulation tools.

Management

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Glossary

Algorithm: a set of mathematical formulas to describe a process.

Aspects: a set of parameters describing the Objects; can be physical data as well as metadata.

Aspect Integrator Platform (AIP): architecture in which Aspects and Objects are linked together for ease of use.

Borehole: a deep hole of some thousand meters for extracting oil or gas from the ground.

Capacitor: a system used to store electrical energy.

CCPP: combined cycle power plant; plants with gas turbines and steam cycle.

COM and .Net: specifications and run-time environments for Microsoft component architectures and programming models to promote software interoperability.

Copy-and-paste engineering: a way to engineer control systems by reusing the data and structures from similar processes.

Deregulated electricity markets: markets in which the provision and trading of electrical power is regulated by market forces, rather than state legislation.

Dielectric fluid: a fluid with electric properties.

FACTS: Flexible AC Transmission Systems.

Fieldbus: communication line between instruments and controllers.

Generator: a rotating machine that produces electric power.

Greenhouse gases: gases that contribute to the greenhouse effect and global warming. The most significant are carbon dioxide (CO_2), water vapor, methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6).

GridView: a software package that analyzes a complex electrical grid including technical as well as economic parameters.

High-Voltage Direct Current (HVDC) Light: an economical technology solution for converting and transporting electrical energy with a direct current at high voltage.

Industrial IT: Industrial IT is ABB's patented concept for linking products and services together with the information needed to run, service and maintain them.

Java: a platform-independent software programming language specially suited for Internet applications.

Micro-Electro Mechanical Systems (MEMS): mechanical systems in the micrometer range for which the electrical supply is integrated on the same silicon chip.

Nanotechnology: a set of technologies that allows the handling of individual molecules or atoms.

Objects: physical objects like motors in an industrial plant; also, well-defined actions like using a purchasing document can be considered Objects.

Olefins: a class of organic chemicals which can be extracted from crude oil.

Operate IT: a software package based on the Aspect Integration Platform (AIP) to efficiently manage industrial processes.

Optimizer: a software package to optimize industrial processes.

Polyethylene: material with excellent properties for electrical insulation.

Predictive maintenance: a method of forecasting when to begin maintenance on a machine or system before a failure occurs.

Transformer: a machine that uses magnetic fields to change the voltage and current levels of electric power.

Web-based: software programs that incorporate the Internet for successful operation.

Technology on the Internet

www.abb.com/technology

The Internet is a playground for most – a place to get more information, download music, order books or investigate obscure areas of interest.

Of course, the Internet is also something more. It is an idea incubator.

Suppose you are a student working on a project at university. ABB's technology Web pages can help you find an expert in your area of interest. You can exchange information and download specific drawings or mathematical calculations. Moreover, you can find the configuration data for a substation or get condition monitoring statistics for preventive maintenance on motors and machines.

We have global research and development labs working together on large projects on the Internet. You can watch streaming video interviews with ABB's technology experts and listen to them discuss strategy and the future direction of research and development.

There is a section devoted to emerging technologies. It chronicles the historical development of nanotechnology, software, wireless applications and Micro-Electro Mechanical Systems (MEMS), and provides some guidance on where ABB will take these technologies in the future.

One of the most valuable parts of ABB's technology site is devoted to publications. It is no secret that ABB has been in the power and automation business for more than 100 years. What isn't widely known is that research papers, periodicals and technology reviews, accumulated during that time, have made their way to the Web.

ABB's products and services are already configured by customers on the Internet, helping the company glean important information about buying decisions and trends in the market.

The technology team wants to apply this learning to future research. One new idea is to create a technology forum, where an engineering problem is made public on ABB's sites. Independent researchers, scientists and students can submit their ideas or findings to the forum and help ABB solve the problem.

From these beginnings, it is possible to see collaborative research – technology experts working around the clock, all over the world – which will spawn an entirely new generation of technology solutions.

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