The ABB India magazine

Energy efficiency special issue
Contents

Power and automation technologies from ABB 3
ABB and energy efficiency 9
Solutions for utilities 18
Solutions for industries 35
Solutions for infrastructure 73
Technology digest 84
Power and productivity for a better world 103
Contributing to a better world 104

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Power and automation technologies from ABB

ABB technology improves control over electricity, enabling power networks to be more reliable, more efficient and more accessible to renewable energy.

Energizing and controlling power plants
Power plant operators aim to run their installations at the highest possible level of efficiency, regardless of the energy source. With more than 125 years of experience and a vast installed base, ABB offers technologies for complete electrical and automation solutions as well as controls and instrumentation products for power generation plants of all kinds.

Power transmission
ABB is a pioneer and market leader in technologies for efficient and reliable transmission of power over long distances with minimal losses. Our ultra-high and high-voltage solutions up to 1000 kV, including technologies like HVDC, HVDC Light, FACTS and cable systems, help transport power and connect transmission grids over land, underground and even underwater.

Substations
Transmission and distribution substations enable power transfers with a range of high and medium voltage products that ensure reliability and efficiency, such as surge arrestors, protection equipment, switchgear and circuit breakers. Transformers adjust voltage levels higher or lower for a vast range of purposes, while special automation systems protect and optimize the flow of power within a substation.

Managing the network
A network management system lets utilities collect, store and analyze data from hundreds of thousands of points in a power network. Systems like network control, SCADA (supervisory control and data acquisition) and utility communications enable real-time monitoring and control with advanced applications for generation, transmission and distribution, and are useful for industry and rail networks as well.
ABB Group Profile

Energy efficiency special issue

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Services

With a global installed base and unparalleled domain expertise, ABB’s service offering encompasses the entire energy value chain, from consulting, repair, refurbishment and maintenance-related services to complete asset management solutions. ABB’s knowledge of installed electrical systems and equipment is unsurpassed, enabling us to design and build new power products and systems, or repair and retrofit older ones.

Plant electrification and energy management

ABB electrification solutions deliver and distribute electricity safely and efficiently throughout manufacturing and processing plants. ABB frequency converters deliver continuous clean electricity in the most demanding industrial applications. ABB energy management systems help customers reduce energy bills and carbon emissions by 5 to 20 percent by lowering energy consumption, minimizing distribution losses and improving generation efficiency.

Process automation and data acquisition

ABB automation systems increase productivity improve energy efficiency and keep workplaces safe. Our systems reduce production costs with better scheduling, execution and management of industrial processes, improving customer service and product quality. ABB instruments measure essential parameters in real time, including pressure, temperature and flow. Our online analyzers monitor critical processes to help manage production quality and emissions.
Material handling and robotics

ABB motors and drives increase energy efficiency in fans, pumps, compressors, conveyors, kilns, centrifuges, mixers, extruders, hoists and cranes. Fast, cost-effective ABB crane systems control lifting and handling for shipping and industrial applications. A global installed base of 160,000 ABB robots do jobs from welding, packing and painting to assembly, materials handling and machine tending with power and precision.

Protection and control

ABB low-voltage circuit breakers, switches and control products protect people, buildings and equipment from electrical overloads. ABB line protection products, wiring accessories, enclosures and cable systems control and protect building installations. When integrated with ABB intelligent building automation systems, energy consumption is optimized and controlled through automated adjustment of lights, heat and ventilation.

Services

ABB services help customers improve the performance of automated systems and equipment. Life-cycle services provide preventive, predictive and corrective maintenance and continual evolution of installed automation equipment. Consulting services help customers use less energy, ensuring process efficiency and reliability. Full service contracts put ABB in charge of engineering, planning, and managing plant maintenance activities.
 Dear friends,

Energy is the lifeline of the economy. We rely on the continuous and predictable nature of its supply for every activity, be it extraction of raw material, manufacturing or transport. Any negative impact on its constant supply will in turn endanger both local and global prosperity.

Rising energy prices, depletion of fossil fuel reserves, concerns about environment degradation, increasing demand due to rapid urbanization and industrialization and losses in consumption have brought topics like energy efficiency and renewable energy on the top of business and public agenda.

As we are all acutely aware, energy is essential to life and its conservation has become an absolute necessity. In this scenario, it is essential for all the stakeholders to come together to question and seek solutions as to where this additional energy is going to come from.

The world’s thirst for energy is growing by leaps and bounds. Fossil fuels are currently the primary source of energy that powers our modern industrial civilization, but with the depletion of fossil fuels, concerns over finding alternative energy sources is on the rise. Relying on traditional sources of energy alone is not a solution any more and it has become imperative to tap under leveraged alternative energy sources such as wind, solar and tidal energy.

Comprehending the gravity, people have begun utilizing energy more judiciously; new primary sources of energy are being explored. Innovative ways of using coal is being promoted; bio-fuels are being developed. Countries are promoting renewable energy through tax incentives and rebates. Energy technologies for the future such as hydrogen and fuel cells are being developed and there is huge optimism regarding nuclear energy.

But none of these solutions would cause an immediate change. We need to seek an alternative which will effect a fast solution and that alternative is of course energy efficiency.

Using less energy to provide the same level of energy service is called energy efficiency. Efficient energy use is achieved primarily by means of a more efficient technology or process coupled with changes in individual behavior. Today almost 20 percent of energy is being wasted. Using the potential of energy efficient technologies would reduce growth in the energy demand by about 50 percent by 2020.

The need for energy efficiency is huge and critical and ABB is dedicated to doing its part. All our products and services in power and automation are designed to a more efficient management of energy. The key advantages of using energy-efficient technology is that saving can be achieved immediately and that saving in energy cost, typically offsets the initial investments.

The new “alternative fuel” is now energy efficiency - after all the greenest energy is energy saved!

Yours sincerely,

Biplab Majumder
Vice Chairman and Managing Director, ABB India
The world is facing a serious energy challenge; how to provide secure power supplies in the face of fast-growing demand and rising concern for the environment.

The economic downturn might slow the pace of growth in energy consumption in the medium term, but won’t eliminate the demand. The International Energy Agency expects demand to rise 45 percent between 2007 and 2030.

Global electricity consumption is set to grow nearly twice as fast as overall energy demand and will almost double by 2030, says the IEA. China alone is expected to triple electricity consumption.

Of particular concern is that CO₂ emissions will grow at the same pace as energy demand unless some dramatic changes are made in the way we produce and use energy.

The European Union has pledged to cut emissions by 20 percent by 2020, and in the U.S., the new Obama administration stated its aim “to reduce greenhouse gas emissions by 80 percent by 2050.” International negotiations are underway for a global treaty to tackle climate change.

Where the savings can be achieved
Climate scientists say that containing global warming will require greenhouse gas levels in the atmosphere to be frozen at around today’s levels. This means annual emissions would have to be cut to half what they were in 2000 by 2050.

The IEA has mapped out how this could be achieved, as well as an alternative scenario under which emissions are trimmed less aggressively. In either scenario, energy efficiency will contribute more than half of savings (see chart 2).

Energy efficiency – the low-hanging fruit
Using energy more efficiently will not only contribute the lion’s share of the emissions reductions needed, it is
arguably the fastest, most sustainable and cheapest way to reduce emissions and enhance global energy security.

Variations in energy efficiency across the world give a sense of what can be achieved with today’s technologies. The most efficient economies generate almost six times more GDP with the same amount of energy than the least efficient (see chart 3).

The key advantages of existing energy-efficient technologies are that they are tried and tested, and investment payback times are short. They provide the opportunity to save energy and reduce environmental impact, without compromising economic development.

**Renewable energy**

Power generation from renewable sources of energy is set to expand rapidly until 2030. The required technologies are maturing and becoming more competitive, concern is growing about the cost and the security of fossil-fuel supplies, and policy support for renewable energy schemes is gathering strength.

The IEA projects total cumulative investment in renewable energy supply from 2007 to 2030 will amount to $5.5 trillion, representing about half of all projected investments in electricity generation during this period. As a result, global electricity generation from renewable sources is projected to double by 2030.

**The ABB contribution**

Energy efficiency and renewable energy are the two areas in which ABB technology can contribute most, and are the focus of special issue of CONTACT.
What would you do if you only had access to 20 percent of your salary? Or if 80 percent of the food you purchased each week got spoiled, and had to be thrown away?

Something like this is happening to our primary energy sources, the raw materials on which our way of life depends. The process of finding and harvesting primary energy resources (such as oil, coal and natural gas), refining them, transporting them, turning them into electricity and delivering it to consumers is only about 20 percent effective. Many of the losses are unavoidable but significant improvements in efficiency can be made.

As the global leader in power transmission and distribution technology, and a leading automation company, ABB can help achieve energy savings at every step of the energy chain, from harvesting primary energy through transportation and processing to power generation, delivery and ultimate end-use.

By reducing power consumption and losses, improving productivity and managing electrical equipment more effectively, ABB technologies can reduce the waste of energy and more than double the current productivity of the energy value chain.

Moreover, ABB is the market leader for key energy-saving technologies in emerging economies, where the energy-efficiency need and potential is greatest. In China and India, ABB is the market leader for power transmission and distribution technology and a leading supplier to fledgling industrial sectors.

Our customers are utilities in power generation, transmission and distribution, and we are also a leading automation and power technology supplier to all industries, including the transportation sector.

The sections below outline how ABB technologies and solutions help save energy at each step of the energy value chain.
ABB helps companies extracting primary energy resources, such as oil, gas and coal, to run their operations more efficiently and use less energy to extract and deliver these products to customers.

In coal mining, efficient motors and drives for hoist systems and conveyor belts can bring cost and efficiency improvements.

A standard liquefied natural gas (LNG) processing plant powered by ABB electric drives saves nearly $100 million annually compared to the conventional gas turbine alternative. Other benefits include improved energy efficiency, maintenance cycles, uptime and lower emissions: a LNG plant with a capacity of 6.25 million metric tons a year would reduce its annual CO₂ emissions by 360,000 metric tons.

For StatoilHydro, ABB provided a 70-kilometer long, high-efficiency underwater power link that delivers emissions-free hydro electricity from the Norwegian mainland to the Troll A gas platform in the North Sea. High voltage direct current (HVDC) technology and high-efficiency motors driving gas delivery equipment have helped slash CO₂ emissions at the platform by 130,000 metric tons per year.

ABB technologies can also improve the recovery rates of primary energy extraction. Our subsea electrification solutions can keep compressor motors running on the seabed, extending the life of oil and gas fields and improving the efficiency of extraction.
Oil and gas is delivered by land and sea - in pipelines or in tankers. LNG exports are expected to triple by 2030, and already Western Europe and North America are increasingly importing liquefied natural gas (LNG) in tankers.

ABB technology can help lower energy losses and reduce CO₂ emissions on land and sea. ABB Azipod® ship propulsion systems reduce fuel consumption by up to 15 percent. ABB also supplies connections so that vessels in port can get electricity from shore rather than generate their own power on board, helping reduce CO₂ and other emissions.

More than half the world’s tankers, container ships, diesel power stations and mining vehicles are fitted with high-performance ABB diesel engine turbochargers, helping them increase engine power output by up to 300 percent.

Pipeline operators manage flows and detect leaks with energy-efficient ABB solutions that combine compressors, drives, instruments and control systems to pump gas through thousands of kilometers of pipelines. Five ABB compressor stations as well as control, automation and electrical systems support the 4,000-kilometer Yamal pipeline, bringing natural gas from western Siberia to western Europe.
Energy efficiency in power generation

For power generation, ABB systems improve the efficiency of fuel combustion, boiler operations and energy consumption in support operations.

Coal is still the main fuel of power generation. Since 1970, the average efficiency of coal-fired power plants has improved by about 20 percent. On average, the efficiency of the process that turns coal into electricity is now 40 percent, while a modern combined heat and power plant (cogeneration plant or CHP) that uses heat produced during power generation to warm nearby buildings can achieve an efficiency of as much as 85 percent.

ABB has designed and commissioned CHP projects around the world. One is at the heart of a district heating system in China that takes heat normally wasted in a cooling tower and uses it to heat homes for about one million people, reducing CO₂ emissions by 500,000 metric tons and SO₂ emissions by 2,200 metric tons annually.

ABB supplies all the electric and automation equipment for power plants except for turbines and boilers. ABB’s power combustion software and precise boiler control systems are helping to minimize losses and better use primary fuel sources by operating the process very close to its limits.

The new 750-megawatt “Walsum 10” coal-fired power plant will be the most efficient in Germany when it goes live in 2010, thanks to ABB’s optimized equipment and monitoring systems, which will help it feed more electricity into the grid than other generating units that use the same amount of fuel.
Energy efficiency in power transmission and distribution

Electricity is sent through transmission and distribution systems to end users who are often hundreds or even thousands of kilometers away. Losses typically range from 6 to 8 percent, but can be as high as 10 percent.

Current technology can save substantial amounts of electricity and increase the capacity of transmission and distribution networks by 16 percent, so more power can reach consumers over existing networks, instead of building new transmission lines and power plants. China increased capacity of a transmission corridor into Beijing by 40 percent using one of these transmission technologies.

The EU commission estimates network losses in the European Union can be cut by up to 48 million megawatt-hours annually with the currently available technology, an amount equal to the power consumption of 13 million EU households.

ABB is the recognized global leader in sophisticated power transmission and distribution technologies, such as high voltage direct current (HVDC) electrical transmission and high-efficiency power and distribution transformers, which significantly reduce power losses.

In China, ABB’s HVDC technology will help cut consumption of raw coal by 40 to 50 million metric tons per year, and eliminate 100 million metric tons of carbon dioxide emissions. Power for Shanghai generated more than 1,000 kilometers away at the Three Gorges hydropower station is sent to the city over two HVDC transmission lines, which save enough electricity per line to power more than 150,000 households.

ABB’s ultrahigh voltage direct current (UHVDC) technology can save about 30 percent of transmission losses on very long power transmission distances above 1,500 kilometers.
Industry consumes about 42 percent of all electricity generated, according to the International Energy Agency. The most energy-intensive industries are cement, chemical, iron and steel.

The vast majority of ABB’s industrial product range improves energy savings by helping factories run more productively with state-of-the-art control systems, automation products and electrical equipment. Our key technologies include controls, enterprise software, instrumentation, low-voltage products, drives, motors, robots and turbochargers.

The energy saving potential in industry is enormous in motor systems alone: hundreds of millions of electric motors driving machines, compressors, fans, pumps or conveyors in virtually all sectors account for about 67 percent of all the electricity industry uses.

More than 90 percent of these motors either cannot adjust their power consumption, or use only crude and grossly inefficient ways to do so. Many are constantly running at full speed regardless of actual output requirement. In many applications, energy use can be cut to one-eighth just by adjusting motor speed to one-half.

ABB has delivered more than 2.5 million energy-efficient motor control devices. The installed base of ABB low-voltage drives alone (just one type of motor control device) saved more than 170 million megawatt-hours of electricity in 2008, equal to the annual electricity consumption of 42 million households in the 27 member states of European Union. In terms of CO₂ emissions, the savings were about 140 million metric tons, equal to the yearly emissions of 35 million cars. Robots are mainly used in industry to increase productivity, improve quality and reduce safety risks to employees. Increasing productivity typically leads to lower scrap rates and therefore lower energy consumption per manufactured unit. Roland Murten AG, a Swiss maker of bakery products, reduced its scrap rate on a pretzel packaging line by 80 percent with ABB robots, cutting energy consumption by 12 percent in the process.
Energy efficiency in commercial and residential buildings

The IEA says cities and towns account for more than 70 percent of global CO$_2$ emissions.

Commercial and residential buildings account for about 38 percent of global end-user energy demand, mainly for heating, cooling and powering electric appliances.

Adjusting the heating temperature, lighting and the energy consumption of electric appliances to the actual requirements offers a substantial energy-saving potential without compromising comfort or quality of life.

Every day, ABB ships one million products for the commercial and residential building sector and is a leading producer of low-voltage devices and automated control and building automation systems that can help to achieve savings mainly in three areas:

- Temperature control can save up to 30 percent
- Lighting control can save up to 50 percent
- Building automation can save up to 60 percent
Barely a day goes by without talk of climate change. The latest scientific reports have shown it is happening faster than experts had expected and that human activity is responsible. If we are to move beyond talk and prevarication, we need urgent solutions.

Renewable energy, carbon capture and biofuels are among the main solutions put forward to mitigate climate change. They are valid methods and must be pursued but the truth is that most of the technologies are either not fully developed, still too expensive or have unwanted side effects.

There is a quicker, cheaper and more effective way of reducing carbon dioxide emissions that can be applied right now: energy-efficient technologies that are commercially viable and proven. Energy efficiency is the low-hanging fruit in the campaign to protect the environment because the technologies exist and we know the savings they will deliver.

China, for example, has vast energy requirements that alternative fuels are not ready to meet. Coal-fired power generation is expected to increase at an average rate of about 5 percent per year over the next quarter century, not because the country is addicted to coal but because that’s the affordable energy source that is available. The issue that needs to be tackled today is how we can help and encourage China to raise the efficiency of those coal-fired power plants to minimize emissions of carbon dioxide.

Similarly in industry, the biggest reductions in emissions in the short term will come from measures to run processes more efficiently. To give an example, about 40 percent of electricity is consumed by industry, and two-thirds of that is used by electric motors. Devices to regulate the speed of a motor can reduce their energy consumption by 50 percent in many applications. Yet less than 10 percent of motors are equipped with such a device.

Fitting them to all the motors shipped in 2006 alone would avoid 200 million tons of carbon dioxide emissions per year, more than the annual emissions of the Netherlands. And there are many more energy saving opportunities like this.

Climate experts from the Intergovernmental Panel on Climate Change say that if global warming is to be limited to +2°C, carbon dioxide emissions must start to fall by 2015 at the latest. This goal must be achieved using existing technology. Industry can make a huge positive contribution but political will and support are needed to exploit the full potential of energy efficiency.

There are many things politicians can do.

- Raise awareness of the financial benefits of energy efficiency. Payback times can be extremely short but many businesses still focus on the purchase price when buying equipment, instead of considering running costs over its lifespan. The purchase price of an electric motor, for instance, is just 1 percent of what the owner will spend on energy to run the equipment over its lifetime.

- Create incentives for businesses and local authorities to save energy. The fairest would be a global price on emissions through a trading system. This will take time to achieve and in the meantime national governments can use standards, rules for public procurement or other means to promote energy efficient technologies.

- Governments should make energy efficiency a criterion of every project they fund, every treaty they negotiate, every research agreement they support, and every school or hospital they build. Others will follow where governments lead.

- Politicians should also consider legislation. Australia plans to ban conventional light bulbs and the European Union is likely to follow. Although energy efficient bulbs achieve huge savings, governments have decided it is taking too long for them to dislodge cheaper conventional lighting.

Efficiency standards were raised sharply in the 1970s without harming growth. On the contrary, it has made economies more resilient to the surge in fuel prices in recent years and helping energy efficient technologies will further reduce dependence on energy imports. Only fear is holding us back from taking much firmer action.

Political and business leaders must do more than pay lip service to the need for greater energy efficiency. They must be bold enough to set their own countries and companies on a course that will make them models for others to follow.
Simple guides to key technologies and energy efficiency

Millions of people around the world benefit from ABB’s technologies without ever coming into contact with them and that’s because ABB’s customers are other businesses. The technologies presented on this page are the most energy efficient amongst the many technologies at ABB and the following short guides explain how they work for the people.

**Power technologies**

**What is FACTS?**
Flexible alternating current transmission systems (FACTS) is a generic term for a group of technologies that increase the transmission capacity of the electricity network, maintain or improve voltage stability and grid reliability and reduce overall power losses.

**What is HVDC?**
High voltage direct current (HVDC) is a technology developed by ABB more than 50 years ago to increase the efficiency of power transmission over long distances.

**What is network management?**
Network management systems monitor and control the electricity network to keep power flowing and to preserve the balance between generation and consumption.

For a detailed description of these technologies, please visit [www.abb.co.in/energyefficiency](http://www.abb.co.in/energyefficiency).

**Automation technologies**

**What is process automation?**
Process automation involves using computer technology and software engineering to help power plants and factories in industries as diverse as paper, mining and cement operate more efficiently and safely.

**What is a variable speed drive?**
A variable speed drive is a equipment that regulates the speed and rotational force, or torque output, of an electric motor.

**What is Azipod®?**
Azipod® is the registered trademark of a family of electric propulsion systems for ships, the first of which was developed by ABB about two decades ago. The latest product in the range is the most energy-efficient electric propulsion system on the market.
Utilities

Focus on technology:

Direct-current transmission

About 6-8 percent of all the electricity leaving power stations never actually reaches consumers, but is lost along the way.

Losses are created by resistance in the metal cables used to conduct the electricity. Resistance converts some of the electrical energy into heat, which then simply dissipates from the power lines into the surrounding atmosphere. The further electricity has to go, the more energy is converted into heat, and ultimately lost.

The problem is that today, electricity has become a long-distance traveler. Offshore wind farms, hydroelectric dams in remote mountainous areas and international power trading systems moving electricity from country to country all demand efficient long-distance transmission systems that can conduct large amounts of electricity across long distances with low losses.

The most efficient technology for this purpose is high voltage direct current (HVDC) transmission. HVDC was developed by ABB more than 50 years ago, and one of its central features is that it achieves lower energy losses during transmission than conventional alternating current (AC) transmission and DC transmission at lower voltages.

HVDC systems need technology to switch electricity from AC (the form in which it is generated) to DC, and then back to AC again at the other end of the transmission. Since the switching process also causes power losses, HVDC is economically viable only for transmission distances greater than 600 kilometers (for overhead lines) and 50 kilometers (for underwater cables).

Over very long distances, however, the potential to save power and money is considerable. Losses amount to about 7.5 percent in a 500-kilovolt (kV) AC system transmitting 3,000 megawatts (MW) over a distance of 1,000 kilometers. This energy loss shrinks to 6 percent when HVDC technology is used at 500 kV.

From small volumes of power over relatively short distances 50 years ago, HVDC transmission technology has been developed to carry much larger amounts of power over much greater distances. The world’s longest and most powerful DC transmission system is currently under construction in China. It will transmit hydro-electricity over a 2,000 kilometer long, 800 kV ultra-high voltage direct current (UHVDC) link between Xiangjiaba and Shanghai. A single overhead line will carry 6,400 MW, with losses of 7 percent. The power will meet the needs of 30 million people in the Shanghai region.
ABB has provided equipment to JSW Energy to maximize the reliability and efficiency of their new power plant in Ratnagiri, in the state of Maharashtra, in western India. ABB has supplied systems to optimize the electrical balance of plant (EBoP) of the plants equipment, including a compact gas insulated switchgear (GIS) and generator transformers.

Building on a long-standing partnership with the JSW Group, ABB’s products and systems will ensure safe and reliable operation of the plant while optimizing its energy consumption. JSW Energy is part of the JSW Group, an Indian conglomerate with interests in steel, power, cement, aluminum, software and infrastructure industries.

The (EBoP) solution has provided an integrated and optimized design for complete electricals in the plant. The compact GIS substation occupies just one fifth of the land needed for a conventional substation, while its protective metal casing increases safety and reliability and reduces the maintenance required.

ABB has also supplied transformers, designed and manufactured for high reliability, reduced life cycle costs with optimized electrical design for minimized losses.

The EBoP solution will provide an integrated and optimized design for plant electricals to increase reliability and reduce losses.
ABB is providing complete electrics and automation for a coal handling plant being set up by ThyssenKrupp Industries for 5 x 800 megawatt (MW) ultra-mega power project (UMPP) being set up at Mundra in Gujarat the western state of India.

ABB’s scope in the project includes engineering, supply, erection and commissioning of conveyors, stackers cum reclaimers and reclaimers in addition to switchboards, control and instrumentation, low voltage and high voltage motors, erection hardware and programmable logic controllers (PLC).

ThyssenKrupp Industries India is a group company of ThyssenKrupp AG, of Germany – one of the world’s largest powerhouse with three main lines of business activity: steel, capital goods and services.

ABB has a long-standing association in multiple sectors with both ThyssenKrupp and Tata Group.

ABB’s solution for the UMPP will ensure reliable and uninterrupted coal supply to the power plant.

ThyssenKrupp is an original equipment manufacturer (OEM) for the UMPP being set up by the Coastal Gujarat Power Ltd (CGPL) - a Tata Group company.

ABB’s solution will ensure reliable and uninterrupted coal supply to the power plant.
ABB has executed major long distance high voltage direct current (HVDC) projects in India, providing reliable and efficient power to the bustling cities of Delhi and Mumbai.

The 1500 MW Rihand - Delhi transmission was put into service in 1990. It transmits power from the Rihand - Singrauli thermal power complex with a combined power generation of several thousand MW, over a distance of 814 km to Dadri station, close to the capital of India. The project was built by National Thermal Power Corporation (NTPC) but after the reorganisation of the Indian power sector the transmission now belongs to the Power Grid Corporation of India (PGCIL).

The 1500 MW Chandrapur - Padghe transmission was put into service in 1998. It transmits power from Chandrapur in the eastern part of Maharashtra over a distance of 736 km to the Mumbai area.

The project provides reliable power to two of India’s biggest metros.

The project was built by the Maharashtra State Electricity Board that also owns the Chandrapur Thermal Power Station with an installed capacity of 2340 MW. Together with MSEB’s share of 577 MW, from NTPC’s Korba Super Thermal Power Station, the total power at Chandrapur’s 400 kV bus is around 2700 MW.

The two projects exhibit a lot of similarities as evident above. Both HVDC transmissions form connections inside a synchronous grid and they are connected in parallel with a number of 400 kV AC lines.

For both transmissions, expansion of the existing 400 kV transmission network by constructing several new 400 kV lines was not feasible due to severe right-of-way constraints. The 400 kV AC option would also have caused stability problems. For these reasons, two other options - construction of an 800 kV AC link, and an HVDC bipole - were considered.

For the 800 kV AC link two lines would have been needed and the constraints of right-of-way would have been almost as severe as for 400 kV. 800 kV AC links would have had a large over-capacity that would have been un-utilised for the foreseeable future. The investment for the 800 kV AC link would have been considerably higher than for the HVDC option. Lower losses in HVDC was an important consideration.

Both HVDC links have been provided with controls that can dampen possible instabilities in the existing 400 kV AC transmission networks.
ABB has executed a turnkey flexible alternating current transmission system (FACTS) project for Power Grid Corporation of India Limited (PGCIL) at Chandrapur to build a fixed and thyristor-controlled series compensation scheme for a 412-kilometer long, 400 kV double-circuit inter-regional tie line.

The line, along with the 1000 MW HVDC back-to-back link in Chandrapur, ensures reliable and efficient power supply and stable inter-regional transfer of power from western to southern India. In addition, this innovative technology has helped PGCIL minimize cascade trippings and chances of a grid collapse, if either pole of the HVDC bipoles were to trip.

ABB has installed thyristor valves and associated cooling system, the complete control systems, as well as digital optical current transformers. The term FACTS covers a number of technologies that enhance the security, capacity and flexibility of power transmission systems.

The system ensures reliable and efficient power supply and stable inter-regional transfer of power.
ABB has executed a high voltage direct current (HVDC) solution for the Powergrid Corporation of India Limited (PGCIL) at Visakhapatnam for transferring 500 megawatt (MW) power in asynchronous mode between eastern and southern grids of India. The high-voltage system has increased transmission capacity and enhanced the power quality between the two grids.

ABB has supplied a 500-megawatt (HVDC) system that connects two regional grids to feed power to millions of consumers in eastern and southern India.

The Vizag II HVDC project has been installed at Gazuwaka, located at Visakhapatnam on India’s southeast coast. Located beside an existing HVDC station, it helped PGCIL increase the capacity for high voltage power exchange between the eastern and southern power grids by 500 MW. In addition, the system provided voltage and frequency support for both grids during power disturbances.

ABB has installed more than half the HVDC systems in the world, including projects in North and South America, Africa, China, India, Australia and Europe.
Efficient solution for export of surplus energy

The first commercial thyristor controlled series compensation (TCSC) project in India and Asia was commissioned by ABB at the central Indian city of Raipur. The 142 MVar TCSC/788 MVar fixed series compensation (FSC) solution was provided to the Power Grid Corporation of India Limited (PGCIL) for facilitating export of surplus energy from eastern to western grid.

ABB has supplied power oscillation damping (POD) controllers in TCSC to counter system disturbances and a special synchronous voltage reversal (SVR) feature prevents potential sub-synchronous resonance (SRR) that may be caused in presence of series capacitors in the circuit.

The project has ensured grid stabilization and enabled large power transfers with minimal losses and maximum efficiency.

The TCSC project on the 412 kms inter-regional Raipur-Rourkela 400 kV double circuit lines has ensured grid stabilization and enabled large power transfers with minimal losses and maximum efficiency.

Inductive reactance compensation with (FSC) has resulted in improved voltage profile and reduced reactive power loading. The solution also enables PGCIL to use Raipur-Rourkela link for inter-regional power transfer from eastern to southern region under contingency outage of one pole of Talcher-II HVDC system.
ABB is executing a project to upgrade and strengthen the power grid in the western Indian state of Maharashtra to help improve the efficiency and reliability of the state’s network.

As part of the project, ABB is building a series of 220kV and 132kV substations for the Maharashtra State Electricity Transmission Company Limited (MSETCL) in the Nashik, Amravati and Nagpur zones of the state. These substations are an integral part of MSETCL’s efforts to reduce transmission and distribution losses to improve its grid efficiency.

These substations will help improve grid reliability and improve energy efficiency by reducing transmission and distribution losses.

ABB is responsible for the system design and engineering, civil works, supply, installation, commissioning and overall project management. The turnkey solution includes the supply of a range of circuit breakers, instrument transformers, power transformers, power line carrier communication (PLCC) equipment, and the supervisory control and data acquisition (SCADA) system to enable better monitoring and control of power supply.

These substations will help improve grid reliability and improve energy efficiency by reducing transmission and distribution losses. MSETCL is one of the largest state power transmission utilities in India. It is reinforcing its transmission network following the addition of generation capacity to meet growing demand for electricity in the state.
ABB is executing a turnkey project to supply 450 MVAR 132 kV capacitor banks along with switchgear and control equipment at eight different locations in Bangladesh. The project, which is the maiden installation of capacitor banks in country, has helped the Power Grid Company of Bangladesh (PGCB) reduce energy losses and increase profitability.

The 132 kV shunt capacitors are installed for reactive power compensation to improve the power factor in PGCB’s network. They also help improve the voltage stability and reduce network losses. Improvement in power factor also results in high power transmission capability and increased control of the power flow.

ABB’s scope includes supply, installation, testing and commissioning of 145 kV circuit breakers, disconnectors, current transformers interposing voltage transformers, lightning arrestors, reactors and control and relay panels.

The solution has proved to be extremely cost effective for the utility. It has improved the quality and reliability of power transmission. Improvement in power factor of the system has improved voltage levels and considerably reduced system losses. It helps protect motors and other critical industrial equipment from voltage fluctuations.

Reduction in transmission losses have contributed to saving of almost 34 MW power. ABB executed its solution in existing substations of PGCB. This also provided a huge cost advantage to the utility in terms of control and space utilization.
ABB has supplied energy efficient low voltage drives to several compressed natural gas (CNG) stations in Bangladesh. The most recent installations are for North Bengal CNG Station in Dhaka and Regal CNG Station in Doyaganj. The drives have contributed to major cost savings for the operators and reduced the running cost of high-end generators.

The North Bengal CNG station had a 150 kW compressor motor. It is mandatory for CNG stations in Bangladesh to have their own captive generation facility. Keeping in mind the block load of their 150 kilowatt (kW) compressor motor, North Bengal required a 450 kilovolt (kVA) generator. Since its operating load was much lesser, the operator sought ABB's expertise in the matter.

ABB connected an ACS800 drive with the 150 kW compressor which enabled North Bengal to purchase 250 KVA generator thereby resulting in considerable savings on investment and recurrent running costs.

In a similar instance Regal CNG station which had two compressor motors of 250 kW and 110 kW capacity respectively, was advised to purchase a 800 KVA generator due to the block load of 250KW compressor motor. Since Regal's operating load would be much less, ABB connected its variable speed drive to the 250 kW compressor and conducted a successful trial on a 600 kVA generator. Regal not only achieved major energy savings by reduction in generator size by 200 kVA and its is operating the compressor motors efficiently round the clock.

The drives ensure fine performance control with smooth transitions between operating modes. This improves process quality and reduces damage caused by sudden stops and starts.

ABB has a major presence in the energy sector of Bangladesh with its wide range of power and automation products and solutions that help optimize operations and energy use.
ABB will help secure Kolkata’s energy requirements with its outdoor ring main units (RMU) being supplied to CESC (erstwhile Calcutta Electricity Supply Corporation) for the city’s electricity distribution. CESC currently has 1400 HT consumers, with 1000 units of 11 and 6 kilo volt (kV) feeders, and 2.2 million LT consumers. Besides Kolkata, ABB has a large installation base of 11 kV indoor and outdoor RMUs in Ahmedabad, Surat, Mumbai, Delhi and Bhiwandi.

RMUs from ABB reduce the restoration time of 11 kV feeders by half. They are ideal for city distribution projects due to distinctive features like front termination, remote access and multiple configuration options. An integrated supervisory control and data acquisition (SCADA) system will ensure precision and speedy power restoration besides facilitating remote access for trouble-shooting and modification.

Gas insulation gives these units a compact design with minimal moving parts; all live parts are enclosed within a stainless steel gas chamber that facilitates enhanced safety. Their hermetic sealing ensures that they require virtually no maintenance. All these factors make power distribution easy, reliable and energy efficient.

Consumers get better quality of power and utilities benefit from higher revenues and low distribution losses. Little wonder that ABB’s RMUs are preferred in mega cities around India and the world over.
ABB’s wide-ranging power and automation solutions for commercial and residential buildings contribute to significant improvements in quality, availability and reliability of power while reducing energy consumption. One such solution implemented for Accenture, a global management consulting, technology services and outsourcing company, has helped the organization improve the energy efficiency and reliability of the power network and protect sensitive equipment at its offices in Chennai and Hyderabad.

Availability of stable power 24x7 is critical to the business of Accenture. An audit to investigate tripping problems in its uninterrupted power supply (UPS) units installed to supply power to large server clusters revealed problems with the stability and quality of the power network in these offices.

Problems such as high neutral ground voltage, high voltage harmonic distortion, high current harmonics, high neutral current, ground neutral transients and high frequency noise surfaced. In addition to these network problems, server rooms at these offices had issues such as voltage harmonic distortion, current harmonics and ground current.

These problems lead to issues such as excessive heating of devices and network components, nuisance tripping of circuit breakers and UPS, blown fuses and overloading.

ABB offered its PQF-S range of active filters as a solution to these problems. Eleven units installed at these offices (7 in Chennai and 4 in Hyderabad), helped Accenture safeguard its business-critical infrastructure and reduce power consumption of UPS units by up to 20 percent. It also improved the power factor at these offices thereby preventing increase in feeding transformer and cable losses as well as cash penalties from power utilities.

ABB’s PQF active filters offer unprecedented ability to clean the power supply of harmonics. They are insensitive to changes in network impedance due to alteration in network topology such as paralleling of sources and switching between mains supply and generator operation.

The PQF monitors line current in real time and processes the measured harmonics as digital signals in a high-power multi-DSP (Digital Signal Processor) based system. The digital controller generates pulse width modulated (PWM) signals which drive integrated gate bi-polar thyristor (IGBT) power modules to inject harmonic currents in the network in exactly the opposite phase to the existing harmonics.

**Key benefits**

- Significant reduction in total harmonic distortion (THD) - up to 95 percent
- Up to 20 percent reduction in UPS power consumption
- Reduction of neutral to ground voltage by 30-40 percent

CONTACT

Energy efficiency special issue
Managing power networks in India’s commercial hub

ABB has designed, engineered and implemented a state-of-the-art supervisory control and data acquisition / distribution management systems (SCADA/DMS) system at Reliance Energy Limited (REL) for its transmission & distribution network in Mumbai, the commercial hub of India located in the western state of Maharashtra. The SCADA/DMS is a single, integrated system for generation, transmission and distribution networks with centralised control and monitoring and providing visibility of the entire transmission and distribution network of REL.

The system helps REL take appropriate action to maintain supply under normal conditions and facilitate quick restoration of power in case of outages. The SCADA system also includes a complete set of distribution management applications as well as a fast acting islanding and load shedding scheme based on real time data, which operates during contingencies, thereby preventing blackouts. The system monitors and controls about 60 main transmission and distribution substations spread across the suburbs of Mumbai as well as the substation at the Dahanu Thermal Power Station located 110 kms from the city.

Key benefits
Enhanced energy efficiency of the distribution system
Faster response time to locate, isolate fault and restore supply
Operational flexibility
Fast archiving and retrieval of data

ABB’s advanced SCADA/DMS system has enabled REL to serve its 2.5 million consumers in its service area of 384 sq. kms in Mumbai suburbs with a reliability level of over 99 percent.
Karnataka Power Transmission Corporation Limited (KPTCL); Karnataka’s leading power transmission utility, serving more than 12 million customers, relies on ABB’s monitoring and control systems designed to strengthen its power network as well as its constituent distribution utilities. ABB has supported KPTCL in other projects as well, but this is the most ambitious project. The network management solution helps KPTCL to oversee its entire transmission and distribution (T&D) network from a single control room, in real time.

KPTCL’s investment in transmission and distribution (T&D) is galloping ahead. Meanwhile, Karnataka plans to add about 10,000 megawatts (MW) of power in the next three to five years, so KPTCL needs to keep track of this major network expansion. ABB’s Network Manager systems supervisory control and data acquisition / energy management system / distribution management system (SCADA/ EMS/DMS) together will monitor and control 830 transmission and distribution substations located across Karnataka, including the city of Bangalore.

The solution helps KPTCL oversee its entire T&D network from a single control room, in real time.

The SCADA/EMS/DMS system will help KPTCL identify and manage problems. The utility will have real-time access to information about line losses, poor supply and voltage irregularities which will give it a head start to analyze the network.

KPTCL will also be able to match power use to revenue and plug leakages in the system. It will equip the company to find out weak areas and plan its power distribution more efficiently.

The real benefit of ABB’s SCADA system will be to provide KPTCL managers with real-time, on-demand access to all the technical information that is currently scattered across the company’s vast power network. This will also help reduce losses and optimize grid efficiency.
Could you give us a brief description of your company and its activities?

At Accenture, we have been helping companies around the world acquire competitive edge by becoming high-performance businesses. Over the past two decades of our presence in India, we have partnered with Indian companies to help them on their journey toward high performance with more than 186,000 people in 49 countries.

Our clients value us for our deep industry expertise, experience and robust research capabilities, and for aggressively driving innovation with thought leadership and implementation to enable them to become high-performance organizations.

Accenture in India is dedicated to helping clients achieve high performance. We combine our deep understanding of local business conditions with extensive global experience of what works to deliver innovative services that help produce clear competitive advantages for our clients.

What would be the approximate energy component in the total cost of operation?

Around 30 percent of the cost is energy.

What ABB products have you invested in recently?

We have been getting breakers of various ratings and active filters. We also use ABB programmable logic controllers (PLC) for synchronization of diesel gensets at our offices.

How have these products and solutions helped improve energy efficiency in your operation?

These products have been very useful, especially active filters. We could achieve excellent power quality through cancellation of harmonics by using the ABB PQF active filters. Reduction in harmonics also helped in reducing the neutral current, N-E voltage and tripping of devices.

Could you specify measurable improvements in your operations since the installation of ABB active filters?

The most significant improvements have been reduction in harmonics and reduced downtime of systems due to tripping of breakers.

How is your experience of working with ABB?

We have had a good experience. When we explained our problem to ABB, your engineers were keen to provide a solution and demonstrate the capabilities of active filters even before we had taken a purchase decision.

Ajit P Pillai
Technical Lead, Accenture Service Pvt. Ltd, Bangalore

These products have been very useful, especially active filters. We could achieve excellent power quality through cancellation of harmonics by using the ABB PQF active filters. Reduction in harmonics also helped in reducing the neutral current, N-E voltage and tripping of devices.
How do you see the development of the power sector in India?

With the new electricity regime ushered in by the Electricity Act, 2003, the power sector is on the move and I see exciting times ahead. The required enablers in the market have been put in place and with reforms in the distribution sector gathering pace and issues of tariff rationalization and regulation being addressed, the business environment is becoming more attractive for investments. Private sector participation across the power value chain is also on the rise.

On an average, India was adding only around 2000 megawatt MW per annum (p.a.) about a decade ago. This increased to about 3600 MW and in the past couple of years it has been almost 6000 MW pa. So there is a pick-up and is expected to go up to approximate 10,000 MW pa during the XI and XII five year plans.

India has always been largely thermal based and coal-dependant in terms of fuel source for power. Although efforts are underway to encourage hydro and wind alternatives and even nuclear fuel, the mix in the medium term will continue to be tilted in favor of thermal, mainly coal. Fuel supply has been an area of concern but it has caught the government’s attention and going forward the focus will be on improved plant utilization, load balancing and grid efficiencies as well as optimization of costs, to bring greater financial viability to the sector. As we increasingly move from load to consumers, electricity producers or utilities can no longer follow the cost plus model – soon markets will drive prices and consumers will drive standards.

What is NTPC’s approach to nuclear power?

We have decided to enter the segment and the preparatory work is underway with a keen sense of focus and all seriousness. We are in dialogue with other nodal agencies like DAE (Dept. of Atomic Energy) and NPC (Nuclear Power Corpn.) and our consultants have already submitted preliminary reports on choice of technology, safety issues, risk perception, fuel supply arrangements etc. We are also in the process of identifying sites.

What are the implications of India switching to ultra high (800 kV) voltage levels?

I look at the recent move towards 765 kV as a logical technology step in our energy evolution. Studies have shown that pit-head located stations and the coming of ultra mega power projects (e.g. 4000 MW) will be an integral part of the evolving power network model. Long distance transmission is the natural corollary and higher voltages e.g. 765 kV allows for higher volumes of power to be transmitted more efficiently through narrow corridors and addressing the ‘accessibility’ challenge.

For contemporary large power stations and longer transmission distances (e.g. over 500 kms) 765 kV AC and HVDC are the natural options. As power plants grow further and transmission distances increase, India may have to consider even higher voltage levels e.g. 1000 kV as China is doing.

What are your thoughts on the role of new technologies like GCBs, GIS and IT tool?

Emerging markets like ours need power capacity and grid networks to be added at a rapid pace. This calls for state-of-the-art technologies and quality equipment to ensure reliable and efficient generation, transmission and distribution of power.

Mr. Chandan Roy
Director, Operations, National Thermal Power Corporation Ltd.

A greater exchange of information between OEM’s and utilities would go a long way in optimizing technology and improving efficiencies.
New technologies are usually deployed on the basis of techno-economic rationale. Solutions such as generator circuit breakers (GCBs) and gas insulated switchgear (GIS) are especially useful where existing power stations have to be expanded and there are many associated challenges like access rights, space limitations, safety aesthetics etc. At our Dadri thermal power station, for instance, we plan to deploy (GCBs) to address space constraints. Installing a GCB in the scheme, the UAT can be charged from the grid while keeping the generator out of the circuit, thereby obviating the need to have a separate station transformer. This provides a good solution for sites with space constraints.

Going forward, we see plant automation systems providing better control, improved efficiencies and less risk of human error. Another major thrust area where the latest technologies are playing a key role is retrofit and modernization of existing plants for efficiency improvements and increased reliability.

Benefits of IT based solutions such as SCADA, GIS, ERP, WAN/LAN, automated meter reading, cash and revenue management systems, PDS are proven across international utilities. NTPC has been deploying the latest automation, control and instrumentation solutions. As life cycles are becoming shorter, constant upgrades are carried out to ensure contemporary systems.

In future we can look forward to a seamlessly interconnected and interactive power value chain which has the capability to integrate traditional power generation seamlessly with an array of locally installed, distributed power sources (e.g., fuel cells and renewables) into a more robust network. At the same time, power systems are becoming more intelligent as they leverage information technology and communications to provide real-time information for better optimization and control. A transformed electricity system would enable an increase in productivity, improve energy efficiency and resource utilization and generate substantial additional wealth to meet the growing societal and environmental needs of the twenty-first century.

Could you briefly summarize NTPC’s vision as India’s leading power generation utility?

NTPC’s vision is to be the largest integrated power utility in India and emerge as a major international player. We plan to be present across the value chain from coal mining and gas exploration to generation, transmission and distribution. Our first coal mine is expected to be on stream by December 2007 and by 2017 we expect to have around 50 MT of inhouse coal production. As the country’s leading power generation utility, NTPC today holds 26 percent share of power generation capacity in the country and will certainly strive to at least retain this. We plan to nearly double our generating capacity from the existing 27000 MW to approximately 51000 MW by 2012 and further increase it to 75000 MW by 2017.

With over 2000 MW under implementation hydro power generation is also a new thrust area for us. Rural electrification is another focus area and we have already set up two pilot projects with as many as 50 projects in various stages of implementation.

By being an integrated player we aim to bring consumer benefits by driving down costs to the bare minimum and to do this we will leverage technology to the fullest. The overriding objective is to maximize productivity, efficiency and reliability.

What has been your experience working with ABB?

We have a long-standing and valued association with ABB and have worked together on many projects. ABB’s technology, domain expertise, experience and execution are their key strengths. Also, the company has a wide range of power products, engineered packages, turnkey systems, retrofits and asset management solutions.

The areas where we look forward to greater co-operation is sharing of knowledge to facilitate smoother operations and support for asset management on an ongoing basis. Sometimes, two basic connectivity links are missing between OEMs and operators in utilities. Firstly, though the operator may have a lot of information, he does not have the required controls to act on the information. Secondly, to run the systems more efficiently, operators need intensive product design knowledge. A greater exchange of information between OEMs and utilities would go a long way in optimizing technologies and improving efficiencies.

Note: Extracted from original interview published in Contact, Issue 4, December 2006.
Electric motors are the workhorses of industry, so commonplace they are estimated to consume about two-thirds of all the electricity used by industry. Since industry accounts for about 42 percent of the world’s electrical consumption, it follows there are enormous opportunities to save energy, simply by improving the way we use electric motors.

Name virtually any industrial activity, and the chances are it uses an electric motor. Motors operate all kinds of machines, fans, pumps, conveyors and compressors in applications as varied as pharmaceuticals and chemical processing, pulp and paper and cement manufacturing, mining and electronics, to name only a few.

The problem is that many of these motors are bigger than they need to be, and most are running constantly at full speed, even when they don’t have to. While the motor keeps on running at full speed, the output of the process is controlled by “throttling,” which is like trying to control your car’s speed by braking with one foot while continuing to accelerate with the other.

This not only wastes a vast amount of energy, but also causes excessive wear and tear on equipment. But there is another way. The speed of a motor can be controlled by gently raising or lowering the amount of power it receives, using a variable speed drive. This simple approach can significantly reduce the amount of electricity a motor uses, and also lengthens the life of equipment that is no longer subjected to the jolting, on/off braking that results form throttling.

By connecting the motor to a variable speed drive (VSD), the motor’s speed can be matched exactly to the job in hand, ensuring that no more power than necessary is used. Typical applications can achieve energy savings of about 30 percent, meaning an investment in variable speed drives can often pay for itself in less than a year.

Using high-efficiency motors in combination with drives is even more effective. The energy savings quickly add up because the energy used to run a motor over its lifetime costs 100 times more than the motor itself.

The International Electrotechnical Commission (IEC) has introduced new standards relating to energy efficient motors, including new rules governing testing methods and three new efficiency classes for motors (from IE3 – the most efficient – to IE1).

The new standards introduce more accurate measuring of motor efficiency. This benefits manufacturers, who can compete on equal terms with competitors, and consumers, who can more easily compare the efficiency of different motors.

The new standards could also reduce emissions significantly, if they encourage most motor manufacturers to improve the efficiency of the motors they sell. ABB manufactures a full range of motors in the IE2 class and premium efficiency motors in the IE3 class.

ABB is the world’s largest maker of electric motors and variable-speed drives. The installed base of ABB low voltage drives alone saved about 170 terawatt-hours (TWh) in 2008, equivalent to the annual energy consumption of more than 42 million households in the 27 member states of the European Union.

If that 170 TWh of power had been generated by electric plants burning fossil fuel, the resulting CO₂ emissions would have been about 140 million metric tons, equivalent to the annual emissions of more than 35 million cars.
ABB’s class of EFF1 motors deployed in various cement plants across the country are helping in cutting energy bills and improving productivity. Electricity is a major input cost in cement plants and motors consume approximately 65 percent of the energy. Energy savings from efficient motors translate into substantial cost savings with a pay-back period of less than one year.

ABB has supplied a large number of EFF1 motors to major cement plants across India. Grasim Industries among India’s premier cement manufacturers, has one of the largest installed bases of these motors spread across its plants in the states of Rajasthan, Haryana, Andhra Pradesh and Karnataka with a total installed capacity of 10.76 million tonnes per annum. These motors continue to enhance the energy efficiency of several other cement plants including ACC Cement, Sagar Cement and Andhra Cement.

In India, ABB manufactures low-voltage motors at its facilities in Faridabad and Bangalore. Motors of 71-132 frame size also exported to customers across Europe and South Asia.

The energy intensive nature of the cement industry makes energy efficiency paramount in bringing down costs and increasing productivity. ABB’s EFF1 LT motors are playing a big role in this endeavor.

**EFF1 motors are classified as highly energy efficient motors and their robust design contributes to enhancing plant productivity by reducing downtime and improving operational efficiencies**
Cement plants are one of the largest consumers of energy. Their electrical energy costs account for about 15-20 percent of the total production cost. The large fans used in the production process consume a major part of electrical energy. Today, a significant number of cement producers are switching over to variable frequency drives (VFD) from the traditional cascade converters also called slip power recovery systems (SPRS) to control the speed of process fans. With the VFDs, the energy consumption can be reduced from 90 kWh/ton to about 70 kWh/ton of cement produced.

One of the first companies to adopt VFDs for speed and torque control of the fans in their plants was Chettinad Cement Corporation Ltd (CCCL). Over the years, ABB has established a long-standing partnership with the cement manufacturer and offered automation solutions that have contributed to significant improvements in the productivity and energy efficiency of CCCL’s plants across India.

Founded in 1962, CCCL is part of the Chettinad Group in India, which has interests in manufacturing, construction and trading. The company’s facility in Karikkali was the first cement plant in India to install variable speed drives (ABB’s ACS 1000 VFDs) for speed and torque control of bag house fan, raw mill fan, cement mill fan and pre-heater fan.

Efficient control of the flow rate by the ACS 1000 not only ensures major savings on energy costs, but also contributes to significant productivity improvements. Of the available controls that can be retrofitted the least energy efficient is a damper and the most energy efficient is the variable speed drive.

Flux optimization of the ACS 1000 reduces the total energy consumption when the drive operates below the nominal load. The total efficiency can be improved by up to 10 percent. Compared with the limited operating speed range of Cascade converters (60 -100 percent), variable speed drives offer a much higher flexibility over the entire speed range (0 -100 percent). Variable speed drives act as soft starters, causing no starting current peaks. This means reduced stress on electrical equipment and lower maintenance costs. The ACS 1000 motor control platform is based on ABB’s direct torque control (DTC) technology which achieves ultimate torque and speed performance.

DTC allows the speed of any standard squirrel cage induction motor to be controlled without the need for expensive and fragile encoders or tachogenerator feedback devices. The ACS 1000 uses the integrated gate commutated thyristor (IGCT) power semiconductor as an integrated protection device. This leads to a lower parts count making the ACS 1000 a drive with outstanding reliability and availability. Due to its ride-through function, the drive system is able to withstand disturbances in power supply.

### Key benefits

- Highest reliability and availability
- Lowest lifetime costs
- Smallest footprint and overall physical size
- Greatest transformer flexibility
- Compliance with international standards including EN (IEC), CE, IEEE, and the first medium voltage drive to be UL listed

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**CONTACT**

Energy efficiency special issue
ABB has provided comprehensive electrics and automation solution for 6500 tons per day (TPD) clinkerisation plant of Star Cement in the United Arab Emirates (UAE). The turnkey solution includes AC 800xA intelligent process control system, HMI and 1500 KVA captive power plant to ensure reliable power supply, optimum productivity and energy consumption.

The automation control system uses ABB’s proven software for CRM application along with user-friendly HMI displays that facilitate better system availability and plant controls resulting in high productivity. This solution also enabled the customer to set higher productivity benchmarks due to smooth operation, control and maintenance of all plant equipment.

ABB’s scope included design, engineering, supply, erection and commissioning of electrical, control and automation systems for the plant. This comprised 11 kV switchboards, MCC/PCC, 1500 KVA gen sets, AC 800xA 5.0 process control system, HMI, test and calibration bench facility, x-ray spectrometer and auto sampling system.

The solution enabled Star Cement to set higher productivity benchmarks due to smooth operation, control and maintenance of all plant equipment.

Cement plant records peak performance with System 800xA
ABB has delivered a modern control and automation solution to the Lafarge Surma Cement Plant, the first fully integrated cement plant in Bangladesh. The solution includes the latest 800xA extended automation platform for this modern plant.

The 800xA process control system (PCS) designed by ABB comprises of three levels. Level 0 contains the field devices (smart transmitters, Remote I/O stations, Sub Control System, Weigh Feeder etc.). The Level 1 has the Control System (AC800M) and Level 2 comprises Plant Supervisory operator stations.

The project comprises the realization on a turnkey basis of Crushing Plant and a Long Belt Conveyor System (LBC) of minimum design capacity of 800 tons per hour, crushing and transporting limestone and shale from the quarries to the integrated cement plant at the Noarai site, located in the north eastern part of Bangladesh.

The limestone and shale quarries are located across the border, in India, approximately 17 km from the Cement Plant. The 7 km portion of the LBC is in India and 10 km is in Bangladesh.

The LBC system is a unique feature of this project. The limestone and shale quarries are located across the border, in India, approximately 17 km from the Cement Plant. The 7 kms portion of the LBC is in India and 10 kms is in Bangladesh. There are total 9 horizontal curves and 4 vertical curves along the conveyor. Along the complete gallery there are total 12 bridges (6 in India and 6 in Bangladesh). The LBC is the longest trans-national single belt conveyor in world.

The crusher and LBC are operated mainly from the Crusher Control Room located in India. However, all the screens of crusher and LBC operation are available in the engineering stations of central control room.

ABB’s innovative automation solution has resulted in huge energy savings for the cement plant. The high efficiency drives and motors help in bringing down the energy costs for the LBC and the 800xA system has optimized the plant processes and increased the productivity manifold.
ABB is supplying auxiliary drives and controls for a thin slab caster rolling (TSCR) facility of Tata Steel in Jamshedpur. The automation solution will help boost the productivity and efficiency of the plant and reduce energy costs.

The solution includes low voltage ACS 800 drives system, transformers, motor control center (MCC) and low voltage power distribution. The compact and durable insulated-gate bipolar transistor (IGBT) low-voltage multi-drives with direct torque control (DTC) technology will significantly boost the productivity of the plant. The DTC technology will provide high level dynamic performance in terms of torque, speed and accuracy.

Tata Steel is one of the world's largest steel companies with an existing annual crude steel production capacity of 30 million tonnes ter annum (MTPA). The Jamshedpur facility has crude steel production capacity of 6.8 MTPA which is slated to increase to 10 MTPA by 2010.
ABB has supplied a wide range of drives and level-1 automation system for an expansion project of a cold rolling mill complex of Bhushan Power and Steel Limited, one of India’s leading producers of flat, round, HR coils and value added products in steel.

Bhushan Steel required a complex automation solution for its 10 cold rolling mills which are being set up as part of the expansion of its completely integrated plant with present capacity of 1.5 million tonnes per annum. As part of the offering, ABB has supplied a Level-1 automation system consisting ACS800 variable speed multi-drive systems, variable speed single drives, variable speed induction motors, flatness control systems and human system interface. The automation solution will help in efficient control and optimizing of energy consumption in the plant and also enhance its productivity.
Metals - steel

Automation solution to cut energy requirement of steel plant

ABB’s solution will optimize the energy requirement of the plant and provide an automation system for controlling the rolling process.

A complete drives and automation solution from ABB will reduce the overall energy requirement at a greenfield integrated stainless steel project of Jindal Steel and Power, Orissa. ABB’s solution will optimize the energy requirement of the plant and provide an automation system for controlling the rolling process.

The greenfield plant will have a capacity of 1.6 million tons per annum. ABB will provide products and solutions for a hot annealing pickling line with single stand 6 hi reduction mill and a cold annealing pickling line with 3 stand 6Hi reduction mills, tension leveler and in line skin pass mill.

ABB will supply high efficiency medium voltage AC Drives and motors for reduction mills and low voltage AC drives for line controls. The scope also includes complete automation system including technological line and mill controls, level-2 automation and mathematical model for 3 stand and 1 stand reduction mills.

The drive system includes frequency converters and motors for the main and auxiliary drives. ABB will provide its latest medium-voltage frequency converter system DriveIT ACS 6000 with direct torque control (DTC) for the main drives in the reduction mill. This system will enhance the efficiency and optimize the operations of MV AC motors with outputs of up to 3MW.

The drive system control DriveIT rolling mill drive will contribute to significant energy savings by combining the converter, motor and drive train for optimum performance. The system allows use of high-speed, high-power motors for the rolling mill and thereby using smaller motors leads to substantial saving of energy.

The rolling mill’s control system will be based on the OperateIT-800xA platform, which gives operators a state-of-the-art tool to follow and supervise the rolling process.
ABB has engineered, designed and delivered drives and automation systems for a new wire rod block line of Sunflag Iron and Steel Company Limited, at Bhandara, in record time.

The system includes ACS800, ACS550 and DCS600 drives along with an AC450 based automation system with Movicon based HMI as replacement for the existing automation system.

The new system has helped increase output resulting in increased mill availability for rolling, hence effective furnace utilization. This has translated into significant energy savings. In addition, the product quality has substantially improved as the finishing mill loop has been very stable during rolling.

Sunflag was facing difficulties in stabilizing the automatic loop control at finishing stands 15 to 18. ABB’s engineering team faced the challenge of pin-pointing the critical problem areas in order to find a solution that could be executed with minimal mill downtime. After a detailed site study, ABB proposed a solution to replace the existing automation system by means of a cost-effective and time saving alternative, without replacing the analog drive system of the mill. The solution was implemented with minimal production loss and the mill was first put into operation to achieve record production in the first month itself.
Drives to optimize production efficiency of new steel plant

ABB is supplying an integrated automation and electrics solution for a combined wire rod and bar mill project of Visa Steel at Kalinganagar in the eastern state of Orrisa. The solution will help to provide stable power and optimize production efficiency at an upcoming integrated 1.5 million tons per annum (MTPA) special and stainless steel plant.

ABB’s scope includes supply, erection and commissioning of ACS 800 low voltage drives for main and auxiliary motors and LT distribution panels. This will be done in coordination with SMS Meer, Italy, who is the technology supplier for the new mill. The automation solution will ensure reliable power distribution and enhance energy efficiency in the plant.

Visa Steel Limited is part of the VISA Group, which has a decade long experience in minerals and metals industries. The company plans to set up integrated steel plants in the other minerals-rich states of Chhattisgarh and Jharkhand.

The automation solution will ensure reliable power distribution and enhance energy consumption in the plant.
ABB has provided electrics and automation solution for the largest blast furnace blower in India at JSW Steel’s Vijaynagar works in Bellary district of Karnataka. ABB’s solution for the blast furnace, which has capacity of 4000 m³/HR (cubic meters per hour), includes 40 megawatt (MW) synchronous motors and load commutated inverters (LCI) starters for smooth starting of the motors. The solution will help JSW reduce the wear and tear of components, optimize the energy consumption in the furnace and boost plant productivity.

Commenting on the successful commissioning of the project, Biplab Majumder, Vice Chairman and Managing Director, ABB India, said, “We have strong capabilities in building such large systems with locally available resources and this achievement is a resultant of introducing new technologies to Indian markets, which in turn makes our customers more productive and efficient. I am proud to say that ABB was instrumental in bringing the technology of electrical motor-driven blast furnace blowers to India, a country which has been traditionally using steam turbines as prime movers.”

The synchronous motor is also the largest of its kind commissioned by ABB in India. These motors drive the axial turbo blowers which provide cold blast in the furnace. By using LCI soft-starters, the motor can be started from standstill or any other speed and connected to the line supply within three minutes. The motor is smoothly transferred from the starting converter to the line supply. This reduces the stress on the line supply and also on the entire mechanical train.

JSW will be able to get additional benefits like, efficient use of power, quick return to operating conditions during shut downs and low impact on power supply network. This results in lower wear and a longer lifetime for the components. It is also important to note that converter starting is extremely reliable under all conditions.

The rate of successful starts is significantly higher than that of conventional starting methods. This is a decisive step towards higher availability and greater cost-effectiveness for blast furnace systems. With conventional starting methods, under worst-case conditions if a start is interrupted, the furnace must cool down in the filled condition and therefore cannot be used for up to 4–7 days.

In addition, JSW will be able to get additional benefits like, efficient use of power, quick return to operating conditions during shut downs and low impact on power supply network. Traditionally, blast furnace blowers in India use steam turbines as prime movers, which are less efficient compared to electrical motor driven blowers and its operating and maintenance costs were relatively higher as well.
ABB has engineered, designed and commissioned a blast furnace with 800xA control system for level-1 automation at Tata Steel’s Jamshedpur facility. The project was completed in record time and has helped in boosting the capacity, availability and efficiency of the plant.

ABB has supplied system 800xA automation solution along with 20 AC 800 M controllers, over 19000 I/Os, eight engineering stations and 16 operator stations spread over six control rooms. It is the largest application of ABB’s System 800xA automation control system for a blast furnace. Since implementation of the solution, the furnace has surpassed its benchmark peak production capacity of 7850 tons per day to touch levels of 9000 tons per day.

Commending ABB for successful commissioning of the furnace, Sharat Kumar, Chief HBF and SP # 4 (Projects), said, “ABB has worked tirelessly and without any reservations on our continuous demands throughout the project until its fruition. A large plant like this can only perform well when its equipment and systems are best-in-class. In order to operate this plant with optimum manpower and with so much ease; it is very important that the plant has the best automation system, and ABB’s System 800xA has provided the ideal platform for successful implementation of the Level-I automation system.”
ABB is revamping the design and automation system of a sinter plant for UK-based Corus-Scunthorpe – a Tata Group company. The solution will enhance plant productivity, efficiency and reliability by improving its Level 1 and 2 based automation system.

ABB is providing turnkey solutions based on its modern IndustrialIT architecture and aspect object technology with 800xA series controllers. The project scope also includes extended operator workplace, which provides enhanced operated facilities for integrated plant operation.

The IndustrialIT architecture extends the reach of traditional distributed control system (DCS) and covers production management, safety, discrete and advanced control, information management, smart instrumentation, smart drives, motor control centers and asset management. It also incorporates documentation management capabilities to achieve high levels of productivity gains.

The new system will help in complete integration of the plant and optimize its performance by solving interruptions without affecting production. The common, strand 1 and strand 2 areas will have both common and specific modes of operation with each other. The stand alone and coal plant areas will operate independently. ABB will develop the detailed control requirements, mode changes implied by the customer URS to integrate and allow the whole sinter plant to operate safely and reliably.

The automation system comprises nine redundant ABB AC 800 M controllers with around 7100 remote I/Os, three aspect servers, three connectivity servers, two application servers, 12 HMIs and one extended operator workplace.
ABB is supplying an advanced medium voltage (MV) multi-drive system as part of the automation solution for a steel mill of Electrosteel Integrated Limited (EIL) at Bokaro in Jharkhand. The solution will optimize the plant performance and energy consumption while ensuring uninterrupted power supply.

The automation package includes ACS 6000 MV drives, variable speed AC multi-drive system, transformers, frequency converters and synchronous motors. The solution will be implemented at the upcoming 1.3 metric tons per annum (MTPA) integrated steel plant of EIL, a subsidiary of Electrosteel Castings Limited (ECL). The plant will produce 0.4 MTPA of wire rods, 0.7 MTPA of reinforcement bards in straight lengths and 0.2 MTPA ductile iron (DI) pipes.

ABB’s MV drives system will feed and control the synchronous motors with outputs up to 6.9 megawatt (MW) and 4.8 MW. By controlling the operation of motors according to the plant load, the drives system will help optimize the power consumption of the mill and ensure uninterrupted production.

ECL is India’s largest manufacturer and one of the few manufacturers of DI spun pipes in the world.
ABB is supplying an electrics and automation solution for a medium section mill of Jindal Steel and Power Limited (JSPL) at Raigarh in Chhattisgarh. The comprehensive solution includes a range of energy efficient automation products that will help JSPL reduce the energy consumption of its plant while intelligent control systems will ensure continuity in the production process.

The project scope includes supply and commissioning of electrics and drives system comprising 33 kV switchboard, power and converter duty transformer, power distribution boards, AC variable speed multi-drive systems, variable speed induction motors, fixed speed and geared motors.

JSPL has a modern, integrated H-beam manufacturing plant at Raigarh. The plant will be equipped with a continuous mill train to produce 1,000,000 tons sections per annum. Parallel flange section manufactured at the mill offers high axial compression and load bearing capacity. It is ideal for infrastructure projects like flyovers, bridges, multi-storied buildings, industrial yards, airports, dams and power plants.
ABB is supplying automation and electrical systems that will be the manufacturing backbone of an upcoming smelter plant of Vedanta Aluminum Limited, one of the largest integrated aluminum producers in the world. ABB’s automation and power products, systems and solutions will enhance the productivity, reliability and energy efficiency of the new aluminum smelter plant in Jharsuguda, in the eastern state of Orissa, India.

ABB will design, supply and build 24 sets of high-power diode rectifier systems for four aluminum pot lines at the new plant. ABB’s scope of supply also includes a new 400/220-kilovolt (kV) switchyard to supply the new smelter plant with reliable power, as well as a high performance process control system with fiber optic current sensors and an ABB MicroSCADA control system for the power distribution network, substation switching bays, power and station transformers.

ABB has already supplied rectifier systems for phase one of the Jharsuguda plant expansion in 2007-08. The new plants will double the smelter’s production capacity of aluminum ingots, rods and rolled products. When phase two is completing in 2009, Vedanta’s total aluminum smelting capacity will be approximately 1,700,000 tons per annum (tpa), making it one of the largest integrated aluminum producers in the world.

The rectifier systems are designed to offer high levels of efficiency with minimal losses in order to optimize energy consumption at the plant and enhance the overall energy efficiency of the smelter.

Vedanta invests in efficiency and productivity for new smelter
ABB has successfully revamped the motor-generator (MG) set-based control for the aluminum sheet rolling mill which is one of the few success stories across the globe. The analogue excitation control has been upgraded to digital control retaining the MG sets, thereby giving improved performance at an affordable cost to customer.

The revamp provides a compact, sophisticated, technologically updated, user-friendly system for smooth operation of its 1650mm wide aluminum mill-based on the MG set control for the main motors.

The existing analogue MG set mill controls were originally commissioned in the seventies, when the complex was established. ABB successfully revamped the system in a record time of 12 days. In addition to the MG set controls, new modern DCS-based on PEC800 forms the heart of the drive and technological control for the mill.

ABB engineers dug deep into the existing control philosophy, to get an understanding of the system which was outdated. This followed by intense home tests, ensured a smooth and trouble free commissioning during the limited shutdown period.

ABB’s unique software for MG set based CRM application along with the user friendly HMI display provides the customer for the better system availability and mill controls resulting in higher productivity. It has also provided substantial improvement in quality hitherto unachieved.

Commending ABB on the job, Narayanan Balakrishnan, Plant 1 Head, BALCO said that “the timely completion of the project and notably the ramp up is truly commendable and gives immense pleasure in rating them as a preferred supplier. We have derived many benefits from this revamp this includes mill availability and increased product portfolio.”

Bharat Aluminium Company Limited (BALCO) has been closely associated with the Indian aluminum industry, playing a pivotal role in making aluminum a leading metal with myriad uses ranging from household and industrial requirements to aerospace applications. BALCO is part of Vedanta Resources; a London listed metals and mining major with aluminum, copper and zinc operations in UK, India and Australia.
Unique mining solution brings out the best results

ABB has used its global expertise in automation solutions for open pit mining and material handling to provide a unique, custom-built automation system for a bucket wheel excavator (BWE) for Neyveli Lignite Corporation Limited, in Tamil Nadu.

ABB introduced, for the first time in India, a variable frequency drive (ACS 800 4Q) for the bucket wheel application, which significantly reduced the wear and tear of buckets and optimizes energy consumption in operation the machine. The indigenously developed solution was implemented in record time and helped in boosting the performance of the bucket wheel.

Bucket-wheel excavators are heavy equipment used in open pit/ surface mining, especially for lignite. It is a continuous excavation machine capable of removing up to 3430 cubic meters of soil/ strata per hour.

The excavation component itself is a large rotating wheel mounted on boom. On the outer edge of the wheel are a series of buckets. As the wheel turns, the buckets remove soil or strata from the target area and carry it around to the rear of the wheel, where it falls onto a conveyor, which carries it up the arm toward the main body of the excavator. Discharge conveyor carries it further and discharges it on the overland conveyor. The most favorable soil and strata conditions for BWE operation are soft, unconsolidated overburden materials without large boulders.

ABB partnered with ThyssenKrupp Industries India Limited, the original equipment manufacturer (OEM) for the project, to develop the unique automation solution. ABB’s scope included composite solutions spanning engineering, manufacturing, supply, erection supervision, testing and commissioning of machine electrics, drives, motors, automation system, and field instruments.

Key benefits

- reduced wear and tear of the buckets
- energy saving
- avoidance of overload trippings
- optimum use of the BWE
- increase in machine availability time

Electric comprised HT switchboard, transformer, motor control centers (MCC) and cables for the complete machine. The automation system included AC800M controller, S800 IO’s and process panel. Communication with the remote IO’s, process panels and field devices is through Profibus network.

The solution was designed after detailed studies, analysis and simulations. The objective of the application software designed to operate the system was to ensure even loading of the conveyor belt, minimize idle operation and form stable slopes. ABB’s application engineering team developed the application programme including the automation of the entire process of soil excavation. This software seamlessly directs the bucket wheel to follow the optimal track, thereby helping the operator to enhance its productivity.
The textile industry is one of the mainstays of Bangladesh’s economy. More than two thirds of Bangladesh’s export earnings come from the garment industry. ABB has been closely associated with the development of the industry in the country. Over 70 percent spinning mills in Bangladesh use ABB drives for optimizing production and energy consumption.

Honkong Shanghai Manila Textile Mill (HSMT) has a capacity of 50,000 spindles and utilizes over 100 motors (22 kilovolt) in short frame ring machines. The company operated a 4 megawatt MW gas-based captive power plant for running the entire load.

HSMT sought greater flexibility in operation of the power plant since the load factor varied according to the production requirement. In the old set up HSMT used star delta starters and gears to operate the motors. There was no possibility of starting all the motors simultaneously due to the huge inrush of current. This adversely affected plant productivity and operation of the gas engines. Repair and replacement of mechanical parts used for operating motors was an additional overhead.

ABB conducted a detailed inspection of the mill and offered the solution of replacing the mechanical setup with 100 ACS 800 LV drives (30 kVA with spinning macro) in all the ring frame machines. Installation drives resulted in immediate energy saving of over 15 percent for HSMT and it also brought in additional benefits like reduction in cost of mechanical and electrical parts. ABB’s spinning macro enabled ease of operation and led to significant jump in productivity levels due to reduced breakdown or interruption in operations.

ABB’s solution has optimized the operation of the ring frame machines and drastically reduced maintenance costs of gas engines.
An Indian manufacturer of biscuit production machinery is using ABB drives to ensure their customers produce high quality biscuits.

Located just outside Mumbai, Bake-O Nomic is one of India’s leading OEMs of biscuit manufacturing lines, producing three fully automated biscuit production plants per year for sale mainly to Nigeria and other African markets.

Since biscuit making is a continuous process, with a number of stages feeding into each other, it is important that each stage is controlled at its own appropriate speed. All the machines, such as biscuit cutting, forming, oven and cooling conveyors are linked to each other, accepting materials or part processed biscuits and passing them on to the next stage.

As each type of biscuit has a different baking time, the company needs a reliable and energy efficient way to vary the speed of the different parts of the process. An example is mixing, which is done in two stages. Shortenings and sugar are mixed at high speed and subsequently flour is added and mixed at a slow speed.

One of the most reliable and energy efficient ways to control this sort of production line is through the use of low voltage AC drives.

Prior to choosing ABB as its preferred supplier, the company had tried locally sourced drives but had experienced many failures. It turned to ABB because of its reputation in the market. ABB is renowned as a reliable supplier with a broad product range. Also, as ABB is a global player, we can benefit from its extensive service network. Should any of our equipment need repairing or maintaining as a result of a drive malfunction, then it can be fixed locally and efficiently.

The drives are used primarily on biscuit cutting and forming machines, mixers, ovens and conveyors. About 20 drives are used in a single biscuit making line, most of them below 5.5 kW, although for mixers, drives as large as 30 kW can be used. Above 0.75 kW, ABB standard drives are used, while below this power ABB machinery drives are used.

Most are individually manually controlled, a method preferred by the company’s customers, who need a fine speed variation depending on the requirements of the type of biscuits being produced.

Bake-O Nomic has used AC drives which saves electricity and fuel, in some blower applications in its own biscuit making plant located in Nashik.
India’s sugar mills are investing in bagasse cogeneration plants and turning to ABB for complete automation and Electrical Balance of Plant (EBoP) solutions that help generate new revenues and provide reliable carbon-neutral power and process steam at near-zero fuel cost.

India, the world’s second largest sugar producer, is encouraging its sugar mills to reap the multiple benefits of investing in bagasse-fueled cogeneration plants, and ABB is playing a crucial role in supplying the automation systems and electrical balance of plant that help make these benefits possible.

Bagasse is the fibrous residue that remains after the sugarcane has been crushed and the juice extracted. It is a biomass fuel with a carbon-neutral rating because it absorbs CO₂ during growth and eliminates the use of fossil fuels in power generation.

The great advantage of a bagasse cogeneration plant is that it provides a stable and reliable source of electricity and steam to power the mill and sugar refining process.

Significant revenues are generated by selling surplus energy to the grid, production costs are reduced by using fuel (bagasse) that is available onsite at virtually zero cost, and production downtime caused by grid outages is eliminated.

The fiber that remains after sugarcane is crushed makes a fuel that eliminates the need for fossil fuels in power generation - it even absorbs CO₂ while the plant is growing.

ABB is the world’s leading supplier of both Distributed Control Systems (DCS) and electrical balance of plant (EBoP) to the power generation industry, and has received a number of recent orders to equip bagasse cogeneration plants for sugar mills in India.

ABB’s scope of supply ranges from complete electrical systems to instrumentation and control, and also includes comprehensive customer support and remote service. DCS solutions are based on ABB’s award-winning and market-leading Extended Automation System 800xA.

System 800xA enables customers to incorporate all their automation functions - including the mills’ process automation systems - in a single operation and engineering environment. It is the only automation system that supports all leading fieldbuses, and is now operating in more than 3,000 installations worldwide.
ABB has been closely associated with the development of energy efficient solutions for the food processing industry in Bangladesh. Apex Foods Limited is one of largest packaged food manufacturers in the country.

The company was using captive power generation with peak load coming from a 250 kW compressor used for their sea food processing plant. The compressor was operated as per the load requirement; however the generator frequently tripped due to the sudden inrush of current as a result of the starting load. This also caused hunting of the generator and made the entire operation very noisy.

ABB offered a solution of connecting a low voltage ACS 800 variable speed drive with the compressor. The low voltage drive helps control the speed and torque of the motor leading to significant reduction in the energy drawn by the motor.

The low voltage drive helps control the speed and torque of the motor leading to significant reduction in the energy drawn by the motor.
Sri Lanka is one of the leading producers of tea in the world. ABB has a close association with the development of this thriving industry. Over 50 tea plantations in central and southern Sri Lanka have reported over 40 percent savings on energy consumption after installing ABB’s low voltage drives and programmable logic controllers (PLC) in their process plants.

The tea making process requires tea leaves to be force dried by blowing heated air into troughs in order to reduce the moisture content of the freshly plucked leaves before they can be processed further. This activity requires modulating speed of fan motors, wherein the speed has to be progressively reduced so that the leaves don’t dry out completely.

The plantations sought ABB’s solutions so that they could prevent energy wastage due to fixed speed of drying fans and idling of motors at regular intervals during the process of transferring semi dried leaves from multiple troughs into a single trough.

ABB installed its range of low voltage drives controlled by PLC-based controllers which facilitated the smooth starting of the motors in full load. The drives controlled the speed without energy loss (energy consumed being almost proportional to motor speed) and also supported basic artificial intelligence through PLC-based HMI with pictorial descriptions of ambient climatic conditions.

Besides reduction in energy consumption the solution has eliminated down time for leaf transfer. Smooth control and enhanced flexibility of operations ensured longer life for the machines. Pictorial HMIs facilitate lesser supervision as the shop floor staff that was not familiar with the system could use the touch screen controllers for operating the fans. The process also resulted in increased productivity and employee satisfaction at reduced cost due to energy saving and also reduction in health and safety risks by minimizing human intervention during the leaf drying process.

ABB’s solution led to 40 percent reduction in energy consumption and eliminated the down time for leaf transfer.

The plantations were also facing the issue of wear and tear of machines due frequent stopping and starting and as a result were incurring a huge cost. It was also important to ensure smooth operation of the motor at variable speeds. Losses on account of frequent starting and regulating of motors, particularly during idling, were also a huge concern.

New benchmark for energy savings at tea plantations in Sri Lanka
ABB is helping one of Bangladesh’s largest industrial houses with a wide range of power and automation technologies to optimize their energy usage and production.

In one unique solution for the consumer division of Abul Khair, ABB implemented intelligent automation systems for removal of block load of ammonia compressors and optimized the operation of gas generators at their food processing plant.

The total operating load of the plant was around 1.5 megawatt (MW). This requirement was met by two 1 MW gas generators. The beverage unit was not operated continuously and when the unit was stopped the operating load would come down to 700 kilowatt (KW).

The plant also has four ammonia compressors of 250 KW, 164 KW and two 132 KW capacity. While one 132 KW compressor ran continuously, the 250 KW and 164 KW compressors were operated based on load requirement.

In most cases, the operating load of the plant required only one 1 MW generator. However, when either of the 250 KW or 164 KW compressors were started, the generator would trip due to the sudden rush of the load. As a result, regardless of the connected load, Abul Khair had to operate both the generators, even as they operated at less than 45 percent of their rated capacity.

After detailed analysis of the plant operations, ABB provided a simple yet innovative solution to Abul Khair, Energy

Abul Khair has saved more than 14 percent energy in operating compressors

meters were connected to compressors for 15 days to ascertain the energy consumption data. Subsequently, ABB connected intelligent low voltage drives with the compressors and measured the energy consumption patterns. The solution provided immediate benefits to Abul Khair as the block load of compressors was removed and one generator was sufficient to operate the entire plant when the beverage plant was not running.

Now, even with all four compressors running the generators do not hunt regardless of frequent manual start and stops of any of the compressors. As a result of this solution, Abul Khair saved more than 14 percent energy in operating the compressors. It also saved the huge energy cost in running an additional generator and optimized the performance of the operational generator.
Seamless information management for pulp and paper industry

A key asset to any business is the effective management of its information. Most business enterprises have data available in plenty, but they lack the expertise to translate this data into information. The Smart Client® from ABB is one such solution that tackles this concern.

ABB recently contributed its expertise to the ITC Group to help enhance their business. ABB provided a solution to three of ITC’s plants predominantly in supplementing the 800xA software with Information Management used to integrate the different core systems installed in these plants. The installation is the first of its kind in India and the largest in Asia.

At the ITC - Bhadrachalam (BPL) plant, ABB installed the system that includes Information Manager (IM) as well as the Smart Client software. At the ITC – Kovai and the ITC - Trebeni plants, ABB installed the system with Information Management to integrate with different core systems installed in the plant. Data from the core system installed at Bhadrachalam also appears on SAP.

The Smart Client has a wide range of advantages due to its dynamic user interface capabilities. At the ITC - Bhadrachalam plant, real-time data is now available at one’s desk. The Smart Client® also makes operations free from programming or scripting.

Detailed project description of these solutions can be found ....

ABB’s Smart Client system will integrate different core systems on to a single system. Data generated from the respective core systems will be connected to the new 800xA core system for monitoring.
ABB has supplied a complete automation solution for a tissue paper machine of Century Pulp and Paper (CPP) at Lalkua in Nanital district of Uttarakhand. The solution helped Century achieve significant operational efficiencies at every level of production within a short span of time.

CPP, a division of Century Textile and Industries Limited, is a leading manufacturer of rayon grade pulp with an exhaustive range of excellent quality of writing and printing paper. The company required a complete automation solution, including drives, distributed control system (DCS) and quality control system (QCS) for its new tissue paper machine. QCS and drive system tuning for paper grade lower than 18 GSM was another important requirement.

ABB’s comprehensive solution includes advanced 800xA extended automation DCS system, PMC 800 low voltage drives with ACS 800 multi drive, AC induction motors and Smart Platform 1200 QCS.

ABB ensured complete integration of drives and QCS with DCS system with common automation hardware for the new as well as existing systems in other areas of the plant.

Key benefits
- Reduction in decision-making time
- Optimized performance
- Integration of production information on common platform
- Improvement in batch production profitability, consistency and traceability
- Enhanced plant asset availability and performance
- Compliance to highest safety standards
- Lower operational and energy costs

Composite automation system improves profitability of tissue paper mill
ITC’s Paper Boards and Specialty Papers Division is one of India’s largest and most technologically advanced paper and paperboards business. The Bhadrachalam unit is India’s largest integrated pulping and paperboard manufacturing unit.

As part of its expansion plan, the company added a new wood free paper machine to this plant. ITC required a complete automation solution for the new plant, including drive, distributed control system (DCS) and quality control system (QCS) for the new machine.

ABB supplied a composite automation solution including System 800xA advanced DCS, PMC 800 low voltage drives with ACS 800 multi-drives, AC induction motors and Smart Platform 1200 QCS with CD actuators.

ITC achieved complete integration of drives and QCS with the DCS. ABB also ensured common automation hardware between the DCS, drives and QCS. The advanced 800xA integrated system provides a common platform for seamless operation, engineering and a host of benefits including ease in conversion of application programs, commissioning, training and replacement of spare parts.

ITC is a multi-business conglomerate with diversified presence in cigarettes, hotels, paperboards and specialty papers, packaging, agri-business, packaged foods and confectionery, information technology, branded apparel, personal care, stationery, safety matches and other FMCG products.
CPM helps ITC achieve production and logistics optimization

ABB’s collaborative production management (CPM) solutions reconcile production requirements with tactical execution. CPM decreases costs through better production scheduling and management, and increases revenues through improved customer service and product quality, to increase profits and enhance shareholder value.

ITC Paperboards and Specialty Papers Division (ITC PSPD), one of India’s largest and most technologically advanced paper and paper boards business, required a centralized monitoring system for collection of critical process and plant data from various production units spread across the country. The company also wanted online reporting of the data of its head office and across production units coupled with data integration with their SAP system.

ITC’s Bhadrachalam unit is India’s largest integrated pulping and paperboard manufacturing unit. Another unit at Kovai unit currently focuses entirely on recycled boards, servicing requirements for both greyback and whiteback recycled boards. A third unit at Tribeni specializes in fine papers and tissues.

Integrating three geographically different locations equipped with DCS from multiple vendors was a major challenge of the project. ABB implemented its cpmPlus Smart Client solution to achieve seamless integration of the three units.

The solution was powered by the System 800xA advanced automation system which provides intelligent data access and viewing functions to assist all levels of personnel in making quick, informed decisions, taking appropriate action, and thereby optimizing plant performance. Displays can be configured using drag-and-drop display components and information from system 800xA property browser.

Implementation of the composite package of cpmPlus Smart Client with System 800xA was the ideal solution for ITC. It not only helped the company achieve seamless integration and control over its three units, but ensured significant cost benefits due to improved system efficiencies, optimized production process and energy consumption.
A composite electrics and automation solution at the Bhigwan paper plant of Ballarpur Industries Limited (BILT) in Pune has ensured energy saving and reduced maintenance costs for India’s largest paper company.

The composite solution helped BILT meet its requirement of seamless integration of different parts of the paper machine to enhance efficiency and save costs. Scope of the electrification and drives solution covers a new fine print paper machine as well as a 30 megawatt (MW) captive power plant.

ABB successfully integrated various parts of the paper machine including in-line coater paper machine, Janus super calendar and vari-flex winder to achieve optimum production efficiency.

The composite solution helped BILT meet its requirement of seamless integration of different parts of the paper machine to enhance efficiency and save costs.

The electrical package supplied to BILT includes 220kV/ 6.6kV switch yard with substation equipment like SF6 circuit breaker, current transformer, potential transformer, lightning arrester, isolator, capacitors and structures. Equipment for the paper machine include paper machine drives, AC motors, medium voltage switch gears, VVVF standalone drives line up, MCC, PCC, HT/LT capacitors and bus ducts.

The Bhigwan plant is the first installation of ABB’s 690V AC low voltage drives package which includes four supply sections, 99 multi-drive inverters and 89 standalone drives. The automation system was designed on PMC 800, a global drive standard solution for paper machines by ABB, which ensured energy saving and reduced operation and maintenance costs for BILT.

BILT is India’s largest manufacturer and exporter of paper with a diversified production infrastructure with six manufacturing units spread across the country.
With eight new turbocharger cartridges received in just four months, ASP benefited from increased efficiency of turbochargers coupled with reduced fuel consumption and operating costs.

Aitken Spence Power (ASP) is a major independent power producer in Sri Lanka with its three plants contributing to 14 percent of the national grid. It is a joint venture between Caterpillar Power Ventures, USA and Wartsila, Finland. It operates three engine-based thermal power plants two 20 megawatt (MW) plants and one 100 MW plant.

ASP was planning to replace eight turbocharger cartridges installed in Wartsila engines at one of its 20 MW plants at Matara. Scheduled maintenance was due on the engine and replacement of cartridges would have accrued huge capital expenditure for ASP. The OPAC solution from ABB enabled ASP to distribute the capital costs into relatively small installments and also relieved them of the responsibility of periodic maintenance of the turbochargers. With eight new turbocharger cartridges received in just four months, ASP benefited from increased efficiency of turbochargers coupled with reduced fuel consumption and operating costs.
A customized operation performance package (OPAC) developed by ABB ensures reliable operation of turbochargers with minimal maintenance expenses for customers. ABB has provided this solution to a Tamil Nadu based independent power producer, Covanta Samalpatti Operating Private Limited (CSOPL), that operates a diesel and heavy furnace oil (HFO) fueled engine-based power plant.

The customized package has helped Samalpatti, a joint venture between Shapoorji Pallonji, Covanta Energy and Wartsila Development and Financial Services, with reliable and cost-effective solution for operation and maintenance of turbochargers installed in Wartsila engines at the plant. CSOPL, which is in-charge of the overall operation and maintenance of the plant, has seven 18V46A Wartsila engines at the plant fitted with ABB’s VTR 454D32 turbochargers. These turbochargers ensure highest level of energy efficiency in operation of the engine and contribute to significant cost savings in running the plant.

In order to ensure reliable and cost-effective method of operating these turbochargers, CSOPL requested ABB to provide a tailor-made solution. As part of the OPAC proposed by ABB, the customer pays ABB based on the fixed agreed running hours per month, while ABB supports the customer with spare parts, maintenance and repair of turbochargers.

ABB also conducted a detailed technical audit of the plant before commencing the OPAC contract and made suggestions to improve the performance and efficiency of the plant. As a result of this solution, CSOPL enjoys the benefit of professional maintenance of turbochargers which ensures increased operation reliability, efficiency, stability and reduced operational costs. Technical design upgrades safeguarded implementation of advanced design status. The package also simplified budgeting of operation costs and eliminated overruns.
ABB has implemented an automated product blending solution at the Panipat refinery of Indian Oil Corporation Limited (IOCL). The advanced blending control (ABC) system is designed to meet the latest emission norms (BS-III and BS-II) for both gasoline and diesel products. The solution has helped IOCL achieve immediate improvements in productivity and quality in addition to significant cost reductions.

As part of an expansion project, IOCL doubled capacity of Panipat refinery from 6 million metric tonne per annum (MMTPA) to 12 MMTPA. The expansion led to increase in number of component streams to be blended to make on-specification petroleum fuel products. IOCL also faced the challenge of meeting Government-specified emission norms by controlling several physical and chemical properties simultaneously for making on-specification products in a single attempt, which is an extremely complex process when attempted manually.

ABB’s automatic product blending solution enabled online analysis of product properties. Online optimized closed loop control with ABC significantly reduces the cost of production and number of attempts involved in manufacturing on-specification products.

ABB’s solution for the Panipat refinery includes the intelligent production management system comprising AC460-MOD300-based regulatory blending control (RBC) and ABB OptimizeIT – advanced blending control.

IOCL accounts for 33.8 percent share of India’s refining capacity with a total of 60.2 MMTPA capacity controlling 10 refineries nationwide. Panipat Refinery is the 2nd largest refinery of IOCL and one of the most complex and technologically advanced refineries in India.

“ABB’s ABC/RBC has enhanced production performance resulting in on-specification product in a single attempt with out having to make repeated tank corrections. This has saved us time and cost thereby maximizing our tanks and products’ availability. Our operators are very happy after the commissioning of ABC/RBC as it has reduced their workload.”

Ravi M R
Deputy General Manager, IOCL
ABB has revamped drives and automation system for two ship-to-shore cranes at the Pipavav Port operated by Gujarat Pipavav Port Limited in the state of Gujarat in western India. The solution had to be implemented in record time to ensure minimum shut down of the port, which is the busiest on the western coast of India.

Automation equipment supplied for the project includes DCS 600 drives for the hoist/gantry, boom/trolley, AC 800M programmable logic controllers and computer maintenance management system and a 1 MVA transformer for the boom trolley. The scope also included enabling grab application in an existing system to ensure greater efficiency and accuracy in handling containers.

ABB’s advanced digital drive technology has significantly extended the life of the existing crane, thereby reducing capital expenditure for the Port. It has also reduced breakdowns due to ageing and non-availability of components, improved productivity and energy efficiency of the material-handling operations.

“ABB has done a wonderful job from dismantling of existing controls, drives, panels and wiring to installing and commissioning new ABB control, drives and PLC panels. The experience of commissioning engineers of ABB on cranes really helped to add all safety interlocks on upgraded equipment to make it more reliable and efficient. Port Pipavav also appreciates the co-operation from ABB for necessary unplanned changes during commissioning and trials.”
In today’s highly competitive business environment, successful companies operate their assets effectively and efficiently while seeking to achieve improved performance. ABB consultants have an extensive experience and a high level of domain expertise, working with clients to deliver high quality asset management solutions as an integral part of operational excellence. This involves detailed condition assessment of the customer’s assets and domain processes with a view to develop comprehensive solutions and bridge the gap to global benchmarks.

Asset management is a performance-based service designed to improve productivity and reduce costs. It is a partnership, where ABB works with customers to continuously maintain and improve asset performance. ABB recently completed asset management projects at the sites of three customers from the process industry.

### Ispat Industries

The project has optimized plant performance by improving maintenance processes and reducing energy consumption and brought significant savings and productivity improvements for Ispat Industries:

- Energy management - Improvement in efficiency of pumps and fans
- Improvement in capacity of Jetty Pipe Conveyor

In the second phase, ABB made maintenance management master plan (MMMP) along with the customer. This master plan for the whole site is made by analyzing the vision of the company and then looking at ways to address the gap between the current situation and the vision. The project focus was on long term improvement plans. It has optimized the plant performance by improving maintenance processes and reducing in energy consumption.

The asset management project was executed at an integrated steel plant of Ispat Industries Limited, located 100 km south of Mumbai. The company manufactures hot-rolled and cold-rolled steel sheets using hot metal, scrap and direct reduction iron to produce hot rolled steel sheets. ISPAT has a cold rolling mill plant at Kalmeshwar, Nagpur, which produces galvanized and colour coated sheets for the consumer durable industry. The company also has plans to set up a captive power plant to meet its energy requirements.

The project was executed in two phases. In the first phase, ABB conducted a detailed benchmarking study for maintenance processes against global best practices. While doing this, ABB suggested following actionable recommendations to the customer that made the project self financing.
ABB's innovative solution for preventing blackouts helped Bharat Aluminum Company Ltd. (BALCO), successfully operate in an island condition for more than 3 hours despite a grid disturbance. BALCO, one of India’s leading integrated aluminum producers, faced periodic blackouts due to grid disturbances leading to financial and production losses.

ABB conducted system studies, network modeling, transient stability studies, and relay coordination, load-shedding and islanding logistics. This was followed by a revamp of the 220 kilovolt kV protection systems and MV switchgear by implementing the composite islanding and load management system (CILMS) solution. CILMS is a complete package for power distribution management which includes high-end software and hardware like the AC800M controller, S800 I/Os, high-end relays and SynchrotactTM relays.

There have been no major incidents at the plant after the implementation of CILMS and the company is able to successfully synchronize with the grid without any loss in power generation or interruption in power supply to smelters. The plant has reported huge productivity improvements and energy savings.

ABB received an emergency call from JSW Steel’s Toranagallu facility where a major fire at one of its Corex installations had crippled the hot metal production. ABB's service engineer reached the remote site within eight hours and after preliminary investigation of the site recommended an immediate solution to replace the local S100 I/O panels with S800 remote I/O panels.

ABB delivered the panels on priority and ensured that the plant was up and running at full capacity in record time. In order to be better prepared for such unscheduled stoppages in future, JSW ordered replacement of panels for its other Corex installation in Toranagallu. Following the replacement, JSW has reported significant savings due to asset optimization, process improvements and enhancement of energy efficiency at its plant.
The paper chase

ITC - Paperboards and Specialty Papers Division (ITC - PSPD) or ITC Bhadrachalam as it is popularly known, is among the leading names in the paper industry. Employing the most contemporary technologies, ITC - PSPD has risen to become one of South Asia’s largest manufacturer of packaging and graphics boards. We met up with Mr. Pradeep Dhobale, CEO of the division to gain some insights into the Indian Pulp & Paper industry and learn more about the recipe behind ITC’s success in a competitive and highly quality conscious market. Mr. Dhobale played a vital role in the planning and commissioning of ITC’s US $ 150 million expansion project. Under his exemplary leadership, ITC Bhadrachalam Paperboards has emerged as the largest single location paper mill in the country and has achieved a dramatic turnaround, in terms of returning to profitability.

Pradeep Dhobale
CEO - ITC PSPD

Can you give us an industry perspective on how the Pulp and Paper sector is emerging in India?

The demand for paper products has traditionally been growing in line with GDP. Till last year, this was around 7 percent and now we are talking about 8 - 10 percent levels, so we expect the sector to see a healthy growth rate going forward.

I hasten to add that the extent to which we can tap this opportunity depends a lot on whether the pulp & paper industry makes the right investments at the right time and proactively addresses cost and quality issues.

To put things in perspective, India is where China was nearly 20 years back, which would mean a per capita consumption of paper of about 6.8 kilogram kg/person/year. Today China has crossed 50 kg per capita and even the world average is at about 45.

In fact, developed countries like USA and Germany are as high as 300 kg per capita. Even if we want to reach the level of China in the next two decades, paper consumption in India has to grow nearly 10 times from the present base.

India’s present capacity stands at about 7 million tons and is projected to reach 15 million tons in the next 10 years. The Indian paper and pulp industry recognizes the growth potential and most established paper players in the country are in capacity expansion and augmentation mode. In many cases, the scale of investment is fairly high in the region of Rs 500 crore and above.

What are ITC’s capacity expansion plans?

ITC has a combined capacity of around 400,000 tonnes per annum. The Bhadrachalam mill (capacity 300,000 TPA) is the largest single location mill in the country. Currently we are looking at a brownfield expansion of around 120,000 tonnes at Bhadrachalam. This would require about 500,000 tonnes of wood which translates to around 25,000 hectares of land to sustain this production. Since we have the finances to invest, our expansion plans depend mainly on how much raw material we can get on-stream and how fast.

How do you address some key environmental and social issues?

We at ITC take our environmental responsibility very seriously and even go beyond the basic requirements of the Pollution Control Board. The Bhadrachalam mill was the first in the country to be an ECF (elemental chlorine free) mill. Chlorine as a bleaching agent is cheap and has been traditionally used in the industry. When chlorine reacts with cellulose fibre, it creates a polluting compound which can be cancerous when exposure is high and continuous. The use of chlorine is still not banned in India and the Government has allowed up to 2008 to implement ECF technology. ITC introduced this in 2002 and all our expansion plans are based on this technology.
Similar to cloning technology and ECF, we are also the first paper company to develop technology for fly ash bricks. All paper industries use a lot of coal, and we generate almost 250 tonnes of ash per day. Power plants also use a lot of coal and dump the ash slurry in lagoons which can lead to contamination of ground water. This is no longer considered as an environment friendly activity. The Government has only ‘recommended’ that lagooning should be stopped.

At ITC, with an investment of Rs 20 lakh we built a plant that used the ash to convert into fly ash bricks. For our mill, we needed four plants and we encouraged local entrepreneurs to set up these plants. Our own factory and colonies are built with fly ash bricks and this helped prove to the community that these bricks are strong. We then worked with the District Collector to convince him about environment friendliness of fly ash bricks. Thereafter, the authorities have been recommending that all government funded buildings in the area should be built only with these bricks.

Today, no company in this industry can survive without paying due regard to environmental issues. We, on our part are proud to have made a positive impact to the environment and the community.

How has automation made a difference to your operations?

We were among the first mills in the country to use automation technologies extensively to build and maintain our leading edge in the industry. Our Bhadrachalam mill is arguably the most automated mill in the country today. We started the factory in the 1980s with single loop controls and then took several automation steps in phases. In the 90’s we implemented distributed control systems (DCS). Two years ago we invested in manufacturing execution systems (MES). We are now on the verge of going in for a fully integrated ERP system. Automation also helps us to optimize costs and improve quality. Our ‘paper’ is practically, untouched by hand!

Automation is also playing a critical role in our material handling functions. For example till the late 90s our production was at 85,000 tonnes with 1400 employees. This year our production stood at 300,000 tonnes with around the same number of employees! In one word - ‘productivity’, largely driven by automation.

An automatic storage and retrieval system (ASRS) is used at our warehouse. The warehouse stores about 3500 tonnes of paper and has a movement of 600 tonnes a day. A typical warehouse like this would require around 200 people - we have one! The entire warehouse is managed with robotic cranes and palletizing.

But I hasten to add, that automation does not take away jobs - it only frees vital human resources for more gainful engagement. People will continue to play an important role in our or any other business. What automation allows us to do is to add fewer numbers during our growth phase and enables productivity and scalability. Higher output in the factory requires more raw material and more jobs get created in plantations.

From a market competitiveness perspective, as customs duty comes down, India will be a huge market not only for domestic paper mills but for international players as well. This will mean added pressure to keep costs in check and automation will play a major role in helping paper mills to optimize costs, ensure quality and increase efficiency.

What’s your experience of working with ABB?

ABB has played a crucial role in automating the plant and implementing our stringent Quality Control System (QCS). Our ULMA Web Inspection system can spot defects up to 0.2 mm diameter and record the coordinates. This was a major investment for us and probably the first of its kind in India. We reposed our confidence in ABB’s technology, domain expertise and global experience. Our automation systems have helped to create value in the factory and bring us a higher return on investment (ROI) through cost optimization, quality control and productivity.

ABB has high-end technology, with a wide range of products and solutions for the pulp and paper sector. Since advanced automation is still new to India, we would like to see greater collaboration between users and providers, especially in terms of optimizing the equipment to maximum advantage. We would also like to see a greater emphasis on service needs to on-site support. In fact, we are looking forward to a regular engagement with the technology providers for maintaining some of our capital equipment. ABB certainly has the domain expertise and are recognized power and automation technology specialists.

Note: Extracted from original interview published in CONTACT, Issue 3, October 2006
Please comment on the increasing importance of productivity and efficiency in the metals industry.

In the present business environment for the manufacturing sector, productivity and cost of production (CoP) play a vital role in ensuring continued success. Typical to all manufacturing sectors and especially for the non-ferrous aluminum industry, competition is global and severe. Hence it is very important for us to operate the plant at a very high level of productivity with very low CoP in order to maintain competitiveness.

With respect to electricals and automation, what are the major imperatives for success?

In the aluminum refinery, which is a mineral processing unit, the variability and standard deviation of any parameter is very important. Only, precise automation and control can give the desired results by minimizing variability, providing consistency and improving efficiency. Similarly, in the smelter, the entire pot control has to be automated. In the fabrication unit, the rolling mills need automation to improve productivity and quality as well as reduce the scrap and rejection.

What are the critical aspects when it comes to maintenance and plant operation?

We operate an asset optimization programme where we give a lot of importance to maintenance management systems. Specific emphasis is given to – availability and reliability of equipment.

When the Vedanta Group took over BALCO, availability of all 3 plants – aluminum refinery, smelter, and fabrication – were in the order of 80 percent, 75 percent and 50 percent respectively. However, with continuous focus on asset optimization we are on course to achieve levels of 93 percent, 95 percent and 80 percent.

Could you briefly summarize BALCO’s vision as one of the top aluminum producers in the country?

Our vision is to produce cumulatively one million tonne of aluminum in the plants located in our Korba facility by 2008-09. Presently, BALCO produces 350,000 tons of aluminum in Plants 1 and 2 in Korba. In Plant 1, we are increasing the present capacity of 115,000 tons to 200,000 tons. We are also adding one new smelter for 530,000 tons in Korba to become a million tonne producer by 2008-09. To support this expansion we are also working on adding approximately 1500 MW capacity to the power plant.

What is your scope of engagement with ABB and your experience?

In order to support 1 MT of aluminum production, we will need around 2370 MW by 2008-09. To ensure optimal utilization of this power, with efficient distribution and organized consumption, we partner with experts like ABB. We have a long-term partnership approach in the critical areas of asset optimization and asset utilization.

In essence, we look forward to ABB’s support – be it in the form of power productivity, automation and even robotics.

Our experience with ABB for our asset optimization programme has been very good. The focus started with an assessment/ study and condition monitoring of BALCO’s electric network assets in terms of availability, utilization, reliability. One of the exemplary outcomes of this program has been the implementation of a comprehensive islanding load management system for the complete electrics in BALCO. For the first time in our history, it saved us from blackout due to grid failure.

We are also in the process of engaging ABB for the program on global benchmarking of operations and processes in the entire plant to improve overall reliability and productivity, achieve sustained growth, asset life extension as well as reduction in maintenance costs. We are quite sure, this is the best way to progress.

Note: Extracted from original interview published in CONTACT, Issue 2, June 2007
ABB has been a partner in development of reliable and energy efficient solutions for India’s capital city, New Delhi. In the last decade, ABB has provided a wide spectrum of solutions for various infrastructure projects in the city including metro rail, airport infrastructure and power distribution systems.

### Efficient solutions for India’s capital city

ABB has been a partner in development of reliable and energy efficient solutions for India’s capital city, New Delhi. In the last decade, ABB has provided a wide spectrum of solutions for various infrastructure projects in the city including metro rail, airport infrastructure and power distribution systems.

#### Ensuring reliable power supply for new airport terminal

ABB is executing a turnkey project for design, supply, installation, testing and commissioning of electrical products and systems for the new Terminal 3 (T3) building at the Indira Gandhi International Airport in Delhi, India. ABB’s solutions are part of a modernization project to prepare the airport for the Commonwealth Games in 2010.

Airports are exceptionally demanding work environments that require extremely reliable and efficient power supplies. ABB’s comprehensive range of energy-efficient electrical products and systems will ensure reliable power distribution and control of power for T3, which is currently under construction.

ABB’s intelligent power distribution management system, SCADA, will be used to monitor and control the terminal’s entire electrical network.

Scope of the order includes 11-kilovolt (kV) panels, distribution transformer, low-voltage panel, cabling, wiring, conduits, light fixtures, bus ducts and uninterrupted power supply (UPS), for dependable backup power if primary power is lost. SCADA provides local and remote control capability for immediate access to real-time network information, as well as easy connectivity to other systems in the electrical network.

ABB products and systems meet the stringent specifications for delivery, execution, reliability, safety, and energy efficiency. Delhi airport’s state-of-the-art terminal T3 will cover an area of 520,000 sq. meters with capacity to handle 25 million passengers, and is scheduled to be operational by March 2010.

#### ABB solutions help improve connectivity and efficiency of Delhi metro

ABB has supplied traction, power supply distribution and supervisory control and data acquisition (SCADA) solutions for the second corridor under phase-II of the Delhi Metro Rail Corporation (DMRC). A wide spectrum of power offerings including a range of switchgear, distribution equipment and remote controlled auxiliaries and automation products like programmable logic controllers (PLCs), drives, low voltage circuit breakers are being deployed. ABB’s building system solutions for DMRC include integrated building management systems and products for electrification, illumination, fire protection and hydraulics.

In addition ABB is also supplying 914 traction motors and 161 traction

The wide range of electrical and automation solutions will help Delhi Metro operate its network with optimum reliability and efficiency.
transformers to Bombardier to be fitted in their coaches for phase-II of the metro. With the completion of phase-II, which is scheduled in 2010, the metro will cover the entire city of Delhi and connect it with adjoining satellite towns. ABB has earlier supplied complete electrics including products and solutions for traction power supply and rolling stock applications for phase I of the metro comprising a route of 65.1 kms in 2006.

### Cutting energy losses in secondary power distribution

ABB partnered with Reliance Energy Limited (REL) to provide an efficient and reliable power distribution network within Delhi. Following the privatization of the power distribution sector in India, REL took over part of the distribution network in Delhi to reduce losses and improve reliability and safety.

**Compact substations contributed to enhanced reliability and efficiency of power supply**

ABB has built its partnership with REL to provide a range of solutions to reduce distribution losses, increase reliability, safety and aesthetics of the power distribution network. REL replaced the old distribution system with latest power products from ABB. The scope of supply included the latest range of compact secondary substations (CSS) which helped to enhance the reliability and efficiency of power supply in Delhi.

The CSS supplied to REL included a 11/0.44kV, 990kVA transformer, an SF6 ring main unit, LT switchgear and an active power factor correction (APFC) panel in a hermetically sealed metal enclosure. Installation of the CSS enhanced the energy efficiency of REL's power network by reducing distribution losses with the use of low loss transformer and improving the power factor using APFC unit. The CSS also increased the reliability of the network with the state-of-the-art HT and LT switchgear. With no live part exposed, the new system also enhanced the safety of REL’s network. Removal of the overhead lines and double-pole structure contributed to reduction in overall space requirement and improvement of aesthetics of the power distribution system.

ABB's compact secondary sub-station is unique due to its modular construction providing great flexibility, simplicity and rigid construction thanks to the path-breaking technology used for the interconnection of modules.

### Designing an efficient power distribution and control system

ABB has designed, engineered and implemented a state-of-the-art SCADA/DMS system for power distribution companies in Delhi. The SCADA/DMS remotely monitors the health of BSES Rajdhani and BSES Yamuna distribution networks in real time and covers all 117 grid stations.

More than 60 grid stations are online from the control center while other stations are being brought up in a phased manner. The system will be expanded to cover 11kV transformers and feeders. It has ensured faster identification, isolation and restoration of faults and reduce restoration time by over 60 percent - from an average of 110 minutes in the past to less than 45 minutes!

BSES commended ABB’s efficient and reliable solution for its distribution network by issuing the following statement: “The adoption of this not only adds a futuristic dimension in the field of electricity distribution but also ensures our consumers live a world class experience. To a customer, it means a remarkable reduction of downtimes, a better voltage profile at consumer homes (by virtue of the voltage and reactive power control modules of DMS), more accurate feedback from the integrated IVRS/ customer complaint system about downtimes and restoration.”

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Mega city projects

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CONTACT

Energy efficiency special issue
ABB will provide an intelligent and efficient lighting control system for illumination of the Jawaharlal Nehru Stadium in New Delhi. A range of energy efficient automation solutions will optimize illumination of one of India’s largest stadiums when it hosts the 2010 Commonwealth Games.

ABB’s AC500 and CP400 programmable logic control (PLC) and automation control systems will illuminate the stadium as athletes from all over the world try to outshine each other for sporting glory. With a capacity of over 100,000 spectators, the JN stadium will employ four gigantic masts and ‘Cat Walk’ lights for providing 1500 lux of illumination.

An AC500 PLC panel will be placed at each quarter of the stadium, with one quarter serving as main hub connected to a supervisory control and data acquisition (SCADA) system and a CP400 controller. The SCADA system will be the key to generate data, reports, alarms, trends etc. of the illumination system. The AC500 PLC will ensure pre-programmed lighting for the stadium. It will be configured to operate in both manual as well as automatic modes.

The auto mode will be designed to have about six levels of lighting sequence for various events such as: practice sessions for football, a yellow glow for athletics, green during football matches, a pink glow during the national athletics, blue illumination during the international match of football and brown for international athletics.

In the manual mode, the PLC-based panel quarter will feature independent touch screen displays for individual operation. An operator will be able to assess the functioning of the individual quarter dedicated lights (Mast and Catwalk). During the selection of manual mode, the auto mode will be disabled and it can be designed quarter wise.

Continuous feedback of each contactor will ensure the hold position. ABB will design and map the lighting requirements of the stadium’s 22 masts and the catwalk. This has long-term advantages as not only will it help in easy illumination but also help in the simpler identification of errors through quarters and sections. The mapping system will also display the lux levels of the lamps through feedback. The system will also generate an error history and provide feedback to the contactor.
ABB is designing a complete energy efficient power supply solution for what will be one of the world’s largest international financial centers and one of India’s biggest ever infrastructure projects - Gujarat International Finance Tec-City.

Occupying a greenfield site of more than 500 acres in the rapidly developing state of Gujarat, Gujarat International Finance Tec-City (GIFT) will be one of the world’s largest international financial services center and IT hub when it is completed in 2017.

The site consists of about 100 million square feet of commercial and residential floor space, including an 80-storey signature building known as Diamond Tower. GIFT is located midway between Gujarat’s two most important cities, Ahmedabad (India’s seventh largest city) and Gandhinagar, and will be linked by expressways and mass transit railway systems. The massive development is expected to provide employment for around 500,000 people and homes for about 50,000.

In addition to advanced information and communications technologies (ICT) systems, GIFT will function as an environment-friendly eco-city, incorporating renewable energy sources like solar power, energy-efficient intelligent buildings and district cooling.

ABB was selected by Fairwood India, the project management consultants for GIFT, to design a complete power distribution system for the entire city with international benchmarks of grid reliability, power quality and energy efficiency.

ABB’s power distribution solution will reduce power losses and energy consumption to levels even better than internationally accepted standards.

The solution is benchmarked against other international installations like Burj Dubai (the tallest building in the world for which, ABB supplied the power equipment); the ABB-designed Barbana underground substation in Spain, which incorporates a waterfall to eradicate transformer noise, dissipate heat and enhance its urban location; and the Hong Kong Electric Company, which has achieved a reliability rating of 99.99 percent every year since 1998.
ABB is providing the electrical infrastructure for modernization of the Kolkata airport, gateway to one of India’s largest metros and the cultural and commercial hub of the East.

ABB is executing the project for supplying the complete power supply package for the airport on behalf of Italian-Thai Development Public Company (ITD) and ITD Cementation, the contractors for the modernization project.

ABB’s solution for safe, reliable and efficient power distribution at the airport includes critical electrical infrastructure and control systems. The comprehensive package comprises several leading edge power technologies, including power and distribution transformers, low voltage switchgear, power backup, busducts, automatic source transfer switches and capacitor panels. The scope of work also includes complete system engineering, supply, installation, testing, commissioning and overall project management.

Reliable power distribution and control is the key for smooth functioning of highly demanding environments like airports. ABB’s energy efficient electrical products and systems will help to ensure passenger comfort and seamless operations at the modernized airport.

Modernization of this strategic airport will play a key role in attracting investments in this region.

The new integrated passenger terminal, which is being built over an area of 180,000 square meters, will handle approximately 20 million passengers every year – four times the current capacity. After modernization, both the runways will be suitable for Airbus A380. This modernization is scheduled for completion by 2011.
Dynamic solution enhances efficiency of railway power network

ABB installed the first Insulated-gate bipolar transistor (IGBT)-based advanced real-time, smooth and dynamic reactive power compensation system at Central Railway, Lasalgaon TSS 132/25 kV traction sub station of the Indian Railway. With the successful implementation of this solution and measurable improvements in system reliability, stability and efficiency, ABB has received several orders for a similar solution in other substations in the Indian Railways network.

Central Railway wanted to improve the power factor of its network from 0.78 to 0.90. ABB recommended installation of STATCON for optimizing the rapidly changing, unpredictable, dynamic traction loads. STATCON is an optimal solution to meet dynamic reactive power compensation requirements and it also helps in saving additional investment in HT switchgear. Its modular design makes it flexible for upgrading kVAR requirements.

The dynamic reactive power compensation (DRPC) solution resulted in drastic reduction of energy bill, reduction in maximum demand, significant improvement in the power factor, reduction in system losses and load current and improvement in voltage profile by almost 750 to 1000V.

STATCON eliminates the problems associated with conventional compensation schemes such as under and over compensation, voltage transients and inrush current problems associated with capacitor switching and erroneous compensation due to poor response. When used in conjunction with harmonic filter banks for traction substations, STATCON is the ideal solution to improve power factor, minimize demand losses and harmonic distortion levels and improve voltage profile. STATCON is approved by the Indian Railways and its application has been proven at several traction substations.
ABB plugs in to India’s water imperative

The water industry in India is still considered a sunrise sector, but there is an increasing awareness on the need for improved water quality and an efficient distribution system. While supply is clearly a key focus area, water utilities are striving to improve the monitoring and control of their water network in order to optimize operations and costs.

Recognizing this need, ABB in India has created a dedicated business vertical or industry specific initiative (ISI) for water. One of the recent projects taken up for the Kerala water supply scheme, in Southern India, involves 34 pumping stations. ABB’s solution to enhance the efficiency of the water network includes Micro-SCADA software, remote terminal units (RTUs), communication through GSM and PSTN lines, flow meters, transmitters, power stations and level transmitters.

The Handri Neeva Sujala Sravanti (HNSS) lift irrigation scheme in the southern state of Andhra Pradesh, is another recent success, involving 12 pumping stations, an ABB Micro-SCADA application, RTUs, communications through radio and instruments for measurement and control. This follows the success of other similar projects for the Bheema, Kalwakurthy, Rajiv Sagar, Pada Sagar, Koli Sagar and Indra Sagar lift irrigation schemes, in the same state, involving 38 pumping stations.

ABB is also executing a prestigious turnkey electrical package for the Dummugudem lift irrigation project in Andhra Pradesh.

ABB’s solutions for these projects include large synchronous machines, LCI starting equipment, control and relay panels, excitation equipment, SCADA system, instrumentation and controls.

There is a significant growth potential in this sector, especially in the areas of improving operational efficiencies, reducing energy costs and optimizing the distribution network with intelligent automation solutions. With its vast portfolio of power and automation products and systems, ABB will continue to enhance the efficiency of the sector - be it to serve agricultural needs or various types of treatment plants.
ABB’s high-end water management solutions enabled the Mauritius government to install advanced technologies for operation and maintenance of the Midland Dam, which has capacity of 25.5 mm³ and it is the main source of water for the country.

ABB has enabled an efficient control mechanism for the flow of water by supplying equipment like electrical panels, racking machine, rotork actuator and lighting.

The rotork actuator operates the main valve and controls the flow of water. A defunct rotork actuator at the dam led to wastage of the precious resource. ABB conducted a detailed analysis of the control systems at the dam. There was a complex and redundant electronic system at the control room. ABB replaced the system with new equipment.

The solution reinstated the rotork actuators thereby restoring normal water supply to the country. ABB’s solution was not only extremely cost effective it also contributed to significant energy savings. The ministry of public utilities was satisfied with the solution and continues to entrust ABB with the operation and maintenance of the control systems at the dam.
ABB's pioneering technology has facilitated the National Water Supply and Drainage Board (NWSDB) at Colombo in setting up a new treatment plant and pumping station. Kalu Ganga water supply project meets the increasing demand for drinking water in the southern part of Greater Colombo area and the Kalutara district of Sri Lanka.

ABB has supplied electrical, instrumentation and control equipment including supervisory control and data acquisition (SCADA) system for pumping stations and treatment plant. The control system deployed includes system 800xA with AC800M controller and S800 IO-system.

In the first stage of the project, 65,000 cubic meters of drinking water a day was treated and delivered. The capacity was then doubled to 130,000 cubic meters per day. Sweet water (drinking water) has always been a scarce resource in Sri Lanka and ABB’s wide range of power and automation technologies have contributed to ensuring its regular and constant supply.

The SCADA application provides a network overview and real-time network pressure and flow data. This data helps in increasing pumping efficiency, optimizing network water pressure, reducing water leakage and decreasing production and distribution cost.

The speed and torque of water is controlled by ABB’s variable speed drives (VSD). As the consumption of water varies during the day the pumps often run on partial load. By controlling the flow and pressure of pumps the VSDs help in operating them at maximum efficiency in different flow conditions.

When controlled by a VSD, a pump consumes only one-eighth of the energy compared to one running at full speed. The drives have also reduced equipment and maintenance costs, increased the reliability and optimized pumping system hence reducing life cycle cost.

By ensuring a fully integrated water system which ties together all parts of the network, including water leakage management system, pumping station control systems and the SCADA systems ABB provided a sustainable solution, by making water suitable for drinking in Sri Lanka.
ABB is providing turnkey energy efficient and reliable electrical solutions for a lift irrigation project in the southern Indian state of Andhra Pradesh. This project, called Dummugudem Lift Irrigation Project, will benefit thousands of farmers around the Godavari river basin region, helping irrigate nearly 330,000 acres of parched land.

About 165 thousand million cubic (tmc) feet of water from the Godavari river at Dummugudem would be pumped to the tail pond of the Nagarjuna Sagar project, where water would join the left canal which supplies water to farms in Nalgonda, Khammam, Prakasam and Guntur districts.

ABB’s solution for the project includes large synchronous machines, LCI starting equipment, control and relay panels, excitation equipment, supervisory control and data acquisition (SCADA) system, instrumentation and controls. ABB will execute the project on behalf of Megha Engineering and Infrastructure Limited, who secured the entire contract from the Government of Andhra Pradesh.

ABB is also providing similar range of products and solutions for the Bhima lift irrigation (Phase I and II) and Kalwakurthy lift irrigation projects.
Bringing water to the farmers

Navayuga Engineering (NECL) is the flagship entity of the Rs.2000 Crores NAVAYUGA Group. NECL, a multi-disciplinary engineering and construction company. In addition to large infrastructure and civil projects, NECL is a key player in changing the irrigation landscape in the country. NECL has considerable experience and expertise in providing solutions in lift irrigation projects, Water intake systems as well as in building dams and barrages. We caught up with Mr. Sashidhar, Director, NECL to get his views on various topics related to irrigation as well as insights on the role of technologies in effective irrigation management.

What is the concept of lift irrigation?
Could you throw light on the importance of this concept to provide relief to parched areas?
The basic principle of lift irrigation is to pump water from a low lying river or water body to a large reservoir constructed at a higher terrain. From these reservoirs water is released (by gravity) to a network of canals / channels to irrigate the surrounding areas. This principle can also be applied to a multistage process where water from one reservoir is allowed to cascade to another bringing elevated areas under irrigation.

Lift irrigation schemes are extremely effective in bringing relief to rocky and hilly terrains as well as fields above the level of the water source. Farmers in landscapes such as these can actually convert stony land to green fields through lift irrigation. This then enables them not only to grow traditional crops but also to diversify into growing flowers, fruit and vegetables.

With the agricultural sector poised for modernisation, what are the key initiatives required with respect to irrigation projects in the country?
Irrigated agriculture has driven much of the increase in global food production over the recent decades. While only 20 percent of the world’s farmland is irrigated, it produces 40 percent of our food supply. The highest yields obtained from irrigation are more than double the highest yields from rainfed agriculture - even low-input irrigation is more productive than high-input rainfed farming. Of the total water available, about 85 percent goes into agriculture and one should remember that assured irrigation for agriculture is critical for economic development.

Irrigation alone is not sufficient for achieving the desired level of improvements in productivity for poverty reduction. To increase productivity of our land it is necessary to match crops to the soil type, select proper seeds, and arrange proper fertilizers in addition to adequate water. The principles of “self help group” for arranging micro financing and “e-choupal” for delivering information system needs be encouraged / adopted. Irrigation projects should be developed as a complementary support to the farmers. Irrigation projects must have involvement from farmers - effort and monetary to bring about a sense of ownership.

What is the role of power and automation technologies in your sector?
What other applications of water management can benefit from such technologies?
Farmers irrigate their fields during periods of dry weather to ensure normal growth. As the irrigators are driven by the water flow, constant pressure is essential for even water distribution over the fields. Automation technologies like motors, automatic pump control, frequency converters etc can play an important role in conserving water and ensuring that the irrigation is sustainable. Some of the benefits of using technology in irrigation projects are:

- Even water distribution due to accurate flow control
- Reduced energy consumption through optimum flow control
- Lower maintenance costs as pressure shocks are eliminated
- Lower labour costs due to automatic control

Each project needs to be optimally designed with the right technologies for a cost effective solution. Technologies for water management, reducing waste water and irrigation scheduling will become increasingly critical as the global water scarcity situation increases.

What has been your experience of working with ABB as a partner?
We are currently working with ABB on Lift irrigation projects - the Kalwakurthy Lift Irrigation Project and the Bhima Lift Irrigation Project (Phase II) in Andhra Pradesh. ABB is providing turnkey electromechanical packages for both irrigation projects. ABB’s turnkey solution includes the 220 kV switchyard, power transformers, a SCADA system, large synchronous machines LCI starting equipment, control and relay panels, excitation equipment, instrumentation and controls.

Our relationship with ABB is relatively new and our experience has been good till date. As we move forward with more projects I hope to see this relationship mature into a mutually beneficial one.

Note: Extracted from original interview published in CONTACT, Issue 1, January 2007
In the globally networked world of today even slight changes of influencing parameters can have a huge effect on the development of society. With the fast changing political scenery, the soaring economic development and ongoing leaps in technology, a forecast into the future is a risky undertaking. Nevertheless, as the future development of the world’s energy is one of the backbones of the global society, the need for reasonable planning is obvious. Utilities need to make long term investment decisions for their power generation portfolio as well as the transmission and distribution infrastructure, providers of alternative energy solutions seek a sound decision platform and, last but not least, industrial groups and their suppliers want to know where market and technological development will lead.
A look into the future is obscured by the fact that disruptive events like pandemics, terrorist attacks and technological breakthroughs may have a significant influence on the development of the world, but they are by nature unpredictable.

Forecasts based on the extrapolation of developed or emerging trends seem to be more reliable within a reasonable time span. As those trends are driven by a few major forces, there is a chance of a meaningful prediction by analyzing these drivers.

ABB has looked at six prominent trends with strong influence on the upcoming needs of people and requirements of the industry. These trends address

- Changes in the global society
- Globalization
- Energy industry restructuring
- Primary energy concerns
- Electrical energy needs
- Environmental issues

Within the next ten years an additional 200 million people will be living in mega-cities, this urban migration being the traditional way for poor people to gain access to better economic conditions.

A rapidly changing global society

Exponential population growth, falling mortality and fertility rates, a shift in the demographic balance between young and old, chronic poverty in much of the southern hemisphere, urbanization and the growth of megacities, mass migration within and between countries, the rising influence of religion in some cultures and growing secularism in others, and the worldwide impact of the digital and IT revolutions – these are all factors that are driving societies and individuals towards increasingly rapid change.

With world population currently at 6.5 billion and rising by 75 million a year, changes in the structure, values and relations within and between societies are the driving force behind all other movements that shape the world we live in.

The population problem is exacerbated in the mature economies by the combination of falling birth rates and longer life expectancy. This is creating ageing populations which could, in time, lead to tension between the younger and older generations 1.

Severe poverty in the least developed countries will remain at a high level, even if the ambitious anti-poverty goals of the United Nations are achieved. The number of conflicts sparked by poverty and injustice is likely to grow, leading to increased social and political instability.

Within the next ten years an additional 200 million people will be living in mega-cities (bringing the total to 600 million by 2015), this urban migration being the traditional way for poor people to gain access to better economic conditions.

People living in urban areas or migrating to developed countries have greater access to global communications platforms like the Internet, TV, and mobile and fixed line phones.

These same technologies are aiding the dissemination of knowledge and taking education into a new dimension. While growth levels of higher education in the mature economies are flattening out, those in the rapidly developing economies are rising steeply. The number of well-trained
engineers in these countries is impressive. In the West, on the other hand, traditional disciplines like electrical engineering have declined resulting in severe shortage of skilled engineers.

With the gradual integration of China, India, and other developing countries into the world economy, hundreds of millions of working-age adults will join a more globally integrated labor market.

**Globalization**

Globalization is driven by new technologies, new economic relationships and the national and international policies of a wide range of actors, including governments, international organizations, business, the media, labor and civil society.

The impact of globalization on individual societies is multi-faceted. The mechanisms by which the flow of trade, capital, ideas and people cause economies and societies to change are highly complex.

The world economy is projected to grow by about 40 percent between 2005 and 2015, and average per capita income by 25 percent. Large parts of the world will enjoy unprecedented prosperity, and a middleclass population could be created for the first time in some formerly poor countries.

With the gradual integration of China, India, and other developing countries into the world economy, hundreds of millions of working-age adults will join a more globally integrated labor market. Existing patterns of production, trade, employment and wages will be transformed.

The greatest benefits of globalization will accrue to those countries and groups that can access and adopt new technologies. The growing two-way flow of high-tech brain power between the developing world and the West, the increasing size of the computer-literate workforce in developing countries, and efforts by global companies to diversify their high-tech operations will foster the spread of new technologies. Information and communication technology (ICT) is an important driver of globalization, facilitating the borderless exchange of ideas, opinions, and data at high speed. It enables multinational companies to work across time zones and obtain an advantage over companies based in only one location.

**Continuous restructuring of the energy industry**

The global energy industry is undergoing continuous restructuring. Processes like liberalization and deregulation, market consolidation, the spread of wholesale energy trading and the commoditization of electricity and gas...
Another driving force is the lack of supply reliability that the various blackouts of 2003 revealed. The fact that energy security has many dimensions such as safe energy supply based on market economics; technological, environmental, social and cultural aspects, as well as being of military strategic importance, adds to the complexity of the restructuring process.

The future of primary energy resources
Most forecasts on future patterns of energy see a continuously rising demand for primary energy in the first two decades of this century. This can best be described as an extrapolation of past development, even though consumption is shifting significantly to emerging economies, in particular China and India.

The primary energy resources of oil, coal, natural gas, and uranium will all still be available in 2020 and beyond. The International Energy Agency (IEA) estimates that a total investment of $16 trillion will be necessary over the next three decades to meet the expected surge in demand for energy, of which 60 percent will be required for power plants and transmission and distribution networks.1)

The correlation between primary energy and gross domestic product has been strong in the past but is expected to lessen over time with the increasing use of energy-efficient technologies in some regions. Nevertheless, global economic growth as a whole will still proceed hand in hand with a rising demand for energy over the next 20 years.

Covering almost 38 percent of world energy consumption oil is expected to remain the dominant energy source in the next two decades, even though more than 30 percent of the resources required have yet to be discovered. Natural gas remains an important source of energy for power generation (about 30 percent). Because it produces lower CO2 emissions, natural gas is an attractive choice for greenhouse gas mitigation.

Consumption of coal will increase in almost all countries except Western Europe. The largest increase is projected for China and India, both of which have huge deposits. These two countries will account for 72 percent of the worldwide increase in coal consumption.

Nuclear power may again become popular in the mature economies after a period of stagnation. Other primary energy resources like wind, wave, geothermal or solar energy will become part of the energy mix but are not expected to contribute significantly to global energy supply in the next 15 to 20 years. Many of the alternative technologies to fill the potential gap in energy supply are still at the development stage and might not become economically viable for some time. Energy savings, especially in the transportation sector,

Footnote 1) See also ABB Review 4/2004.
could significantly extend the availability of oil. Biofuels of different types will also reduce this sector’s dependence on oil.

The growth in new business opportunities is compounded by uncertainty about the future of primary energy resources.

In summary, uncertainty about primary energy resources is driven by:

- Limited accessibility to energy resources for political reasons
- Limited availability of economically viable technologies for exploiting future resources
- Limited availability of alternative energy resources to replace traditional sources to a sufficient extent and at an affordable cost
- Limited use of fossil fuels to prevent impacting the environment and at affordable cost.

Changing electrical energy needs

With demand growing at a constant rate and with most of that growth taking place in developing countries, the regional differences in the way electricity is generated, distributed and used are likely to be accentuated. In the mature economies the ageing infrastructure poses a challenge. In emerging economies new installations have to be constructed and the need for technologies that protect the environment and reduce energy intensity is high on a global scale.

Although the energy mix for power generation is not expected to change significantly, those countries that increase the amount of renewable energy in their mix will need to address grid reliability. Transmission and distribution grids in many parts of the world are operating close to their capacity limits and although new grids are being built in the rapidly growing Asian economies, they are not being built fast enough to meet escalating demand.

The top priority for all countries will be to ensure a reliable supply of electric power with the cost of refurbishing existing grids or building new ones being a major challenge.

In China and India, this is leading to the construction of new power plants in remote locations close to primary energy sources. New transmission lines with the capacity to deliver large volumes of power are therefore required.

Many utilities see reliability as one of their most pressing concerns as the impact of poor reliability on society as a whole can be crippling. The blackouts in the United States are estimated to have incurred costs and lost revenues of more than 10 billion dollars, and are attributed to underinvestment in transmission and distribution capacity and the use of outdated technology and incorrect operating procedures.

Attempts to reduce system losses are driven by environmental factors as well as the requirement for supply security. Modern transmission and distribution systems tend to lose 6–7 percent of the electricity they transport. Approximately 70 percent of those losses occur in the distribution system, which is more extensive than the transmission system and operates at a lower voltage level.

Not only utilities are keen to reduce losses. Electrical energy savings have a direct impact on the bottom line of industrial plants, commercial businesses and households. This drives the demand for energy-efficient electrical equipment like motors, drives and consumer appliances.

Technology development has opened new ways of managing grids. Progress in static reactive power compensation and power storage technologies enables new sources of electrical energy to be connected to existing grids. Power electronics have made it possible to control grids and new FACTS (flexible AC transmission systems) devices are improving controllability.

Technologies that save energy or improve efficiency are becoming more widespread. Low-loss and energy efficient power semiconductors are reducing losses in the grid. Continuous reductions in energy loss are being achieved by advanced motors and power-electronics-based variable speed drives.
R&D initiatives on “smart” or “selfhealing” grids that improve supply reliability are also driven by advances in information and communication technology.

The environment as a business factor

Even though the debate on the scale and impact of environmental change is ongoing, there is a consensus that the world has a set of compelling problems to solve like greenhouse gas emissions, climate change, and the depletion of natural resources.

The concern, perceived as most pressing in the world today, largely because of the global reach of its potential impact, is the growth in concentrations of greenhouse gases. The increasing importance of emission reducing technologies is a catalyst for new business opportunities. These opportunities lie in zero- and low emission technologies for the power generation and manufacturing industries, and in improving the energy efficiency of industrial processes and equipment by using efficient motors and applying variable speed drives.

The growth in new business opportunities is compounded by uncertainty about the future of primary energy resources. This is likely to intensify research into technologies for generating renewable energy and the use of alternative bio-fuels in the transportation industry. In recent years, the technologies used to burn fossil fuels of all kinds have improved tremendously. This applies to oil, gas and coal as well as to combustion engines in cars.

Nevertheless, the development of new technologies will most likely be driven by the tradeoff between the cost of these technologies and the various benefits they offer – tax breaks, lower emissions, reduced fuel consumption, and longer service life.

The renewed interest in building nuclear power plants may inhibit the spread of alternative forms of power generation. The tradeoff between clean energy restrictions and economic growth is, however, complicating the implementation of measures especially in the rapidly emerging countries.

Looking back from 2015

An ABB analysis

Friedrich Pinnekamp

This study was conducted based on interviews, written statements and personal discussions with a large number of external experts, opinion leaders, politicians and members of the scientific community.

The majority of these authorities considered that a closing up of national economies is more likely than a move towards a global society. They further believed that the gap between the emerging and mature economies will continue to close, with both groups seeing some growth.

ABB is taking these indications seriously and is preparing for the various possible scenarios. Even though the uncertainty of the future direction is high, there is one overriding concern in all the scenarios – energy efficiency.

In the global and open society with virtually free access to energy for all, it is the general shortage of primary energy and shared environmental concerns that dictate the careful use of energy. If the world turns towards more protectionism, it is the lack of security in its supply that forbids excessive use of energy.

When the development of the emerging economies gathers speed again, it is once more the shortage of resources that hampers their growth. For a stagnating mature society it is simple economic reality that forces a reduction of energy consumption.

So, in the next decade, energy efficiency is the name of the game.
Assumption of growth rate measured at purchased power parity varies from five percent in the first scenario to three percent in the last.

<table>
<thead>
<tr>
<th>Economic growth</th>
<th>Open global society</th>
<th>Mature economies become more competitive</th>
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<tbody>
<tr>
<td>Prosperity has been taking hold of most regions over the last decade. Strong trading blocks (for example the European Union) exist, but their purpose is not protectionist – they are well integrated into a global economy.</td>
<td>Growth in the mature industrialized part of the world has been strong for a decade. It has been possible to maintain a balance between high standard of living and international competitiveness. Worldwide growth has not met earlier expectations, hence prosperity has not spread globally.</td>
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| World characteristics | The world economy is globalized with free flow of goods, labor, technology and finance. The WTO has produced treaties to secure cross-border trade. Multinational companies prosper in this climate. | Governments of the mature countries have benefited from their export strength and secured markets beyond their own economies. Emerging economies have been more protectionist against foreign influence. |

| Attributes of societies | Societies have become well-integrated into the global market with their flexible labor forces. Most of the world’s population has access to knowledge and electricity – both of these are foundations for prosperity. | Strong economic growth has enabled the mature economies to ease the burden of an aging population by attracting young and educated migration workers. |

| Energy market | Steady price rises for oil and gas have made energy efficiency a global priority. More and more alternative energy sources are becoming economical and the exploitation of previously uneconomical oil and gas finds is gradually being realised. | High energy prices underline conservation and alternative generation is having an impact. Liberalization of the energy market is ongoing. To secure energy in a world of dwindling primary resources, many bilateral agreements have been made between increasingly powerful suppliers. |

| Power grid | The electricity grid is being expanded all over the world to reach most of the global village. There are no signs of consolidation and power sales remain in the hands of suppliers. | The replacement of outdated infrastructure has had a positive influence on the competitiveness of mature economies. The volume of new grid installations in the developing countries has been lower than expected. |

| Environment | Climate change, biodiversity and the health of the environment are concerns of more people than ever. Political leaders and large companies in all economies of the world are tackling the issue of energy efficiency and global warming, a concern that has now gathered momentum. | Trading schemes for CO2 reduction have been established in most mature economies. Fuel for transportation is increasingly being derived from oil-independent sources (which are mainly promoted in mature economies). |

| Technologies | The opportunity to develop modern grids has provided impetus for the introduction of new technologies such as ultra-HVDC and ultra-HVAC, current limiters, high power circuit breakers and super conductive systems. New methods for energy storage have promoted renewable generation. | The positive economic climate in the mature economies has spurred R&D investments in both the public and industrial sectors beyond expectation. |
## Emerging economies get stronger

Having failed to reform early in the new century, the mature economies struggle to keep up with the exceedingly exuberant developing nations, primarily in Asia: China, India, South Korea and to some degree the Middle East have capitalized on their increasingly educated but still cheap labor force.

Globalization has facilitated the full participation of emerging economies on the global market. WTO treaties were sufficiently effective to promote international trade between most regions. Multinational companies have adapted their global footprint to better make use of the strengths of the various regions.

As conditions in the developing nations have improved, migration of skilled labor has slowed considerably. Living standards are improving and these nations are driving global consumerism.

Energy demand has increased beyond what was planned for a decade ago. To meet this great need for primary energy, the development of energy efficiency and alternative energies including nuclear are high on the agenda everywhere. Bilateral energy agreements are sought wherever possible in an attempt to secure access to limited resources.

The mature economies have only partially been able to replace their outdated electrical equipment and networks. Large investments in new infrastructure has, however, gone into the emerging economies in an attempt to redress the imbalance between supply and demand in those areas.

Due to environmental awareness in the emerging economies, these have succeeded in implementing the necessary regulations to control their pollution. The latest technologies are playing an important part in making this possible. The global expansion of nuclear power, promotion of renewable energy and energy efficiency measures have reduced the threat of energy shortage.

The insatiable energy demand of the emerging economies has led to the installation of cutting-edge technologies for high productivity generation and transmission of electricity. Combined with the latest energy efficiency applications in new factories, this has resulted in these young economies gaining further advantages over their more mature competitors.

## Retreat into protectionism

Stagnation in the global economy, including recession in some parts of the world, has lasted for a decade. Global trade has slowed significantly and domestic markets have grown in importance. Western economies have been affected by the slowdown in Asia, an area that could not maintain its past growth rate. International cooperation is limited. Nations are becoming introverted and are seeking self-sufficiency.

Asia is affected by social unrest, environmental challenges and over-heated economies. The WTO has failed to provide a foundation for sustained international trade. Disappointed governments have turned to protectionism, resulting in decreasing standards of living even in the mature economies. Movement of people and labor, knowledge and technology is restricted.

A large number of people in the world are still without electricity, a situation unlikely to change due to financial difficulties in these countries and the tough investment climate. Access to information remains restricted in countries with closed societies.

Global stagnation has reduced the expected energy demand compared to forecasts of 10 years ago. The need for primary energy is still acute, but with protectionism and the desire for self-sufficiency in ascendance, energy efficiency measures, alternative energy and nuclear power are prioritized. Difficulties in securing access to primary energy through long-term bilateral agreements have grown as supplying countries are closing ranks to drive up prices. The risk of war over energy is escalating.

In response to the black-outs of ten years ago, the mature economies have squeezed existing infrastructure to its limits without major investments in the electrical grid. Many grid interconnections were planned but only a few implemented. The emerging countries have been installing new grids but not at the pace intended.

As global cooperation has crumbled, so has the worldwide initiative related to climate change issues and CO2 trading. National initiatives driven more by local priorities for clean air than any global concerns have taken their place. Alternative fuels are slowly entering the markets of the mature economies.

Only few new technologies for generation, transmission and energy savings have been introduced in the energy sector.
How to meet the challenge of climate change
Anders H. Nordstrom

It’s been called “a disaster in slow-motion.” The impacts are already severe but the real threat is probably a couple of generations away. Scientists have been gathering evidence for decades but, until recently, societies have hesitated to take action. Today climate change is on everybody’s lips and governments all over the world are taking measures to curb greenhouse gas emissions. However, the challenge is huge: The world is like a super tanker heading toward the rocks and a quick but difficult turnaround is badly needed.

The mitigation of climate change is a long-term issue that calls for significant changes in the way industry and society at large produce and use energy and electricity. For its part, ABB has been and will continue to be committed to helping its customers use energy more efficiently and reduce their environmental impact through a broad array of products, systems and services. It has a two-year rolling target to reduce its use of energy per manufactured unit by 5 percent.
It is well established that the world is getting warmer. Meteorologists have observed an increase in the average global surface temperature of 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the last century. At the same time the CO₂ concentration in the atmosphere has risen from 280 parts per million (ppm) before the industrial revolution to nearly 390 ppm today. This by far exceeds the natural CO₂ levels in the atmosphere over the last 650,000 years!

This increase is entirely the result of human activity caused mainly by the burning of fossil fuels, and the rise continues at a rate of 2 ppm per year. The Intergovernmental Panel on Climate Change (IPCC) has concluded that most of the observed temperature increases since the middle of the 20th century is very likely due to the rise in greenhouse gas concentrations. This conclusion is based on thousands of studies made by scientists in different disciplines all over the world.

**Climate history and predictions**

In various ways, nature has kept records of its own climate history and scientists have developed methods to study and interpret these data. For example, historical temperatures can be deduced from tree-ring widths and coral growth, and valuable climate data are hidden in the Arctic and Antarctic ice layers. Also, by studying the composition of air in bubbles deep down in the ice, the CO₂ concentration at a specific time can be determined. The average temperature of the period in question can be determined by measuring the ratio between different isotopes of oxygen in the ice. Mass spectroscopy allows very accurate determination of this ratio and may even resolve seasonal variations. Up to now, ice-core studies have revealed information about several hundred thousand years of climate history.

From the mid-19th century, instrumental temperature records have been used to determine the average global surface temperature. Regular measurements of CO₂ concentration in the atmosphere started in 1958 in Hawaii and accumulated data show an upward trend in CO₂ concentration and characteristic seasonal variations.

Over the last century, meteorologists have observed an increase in the average global surface temperature of 0.74 °C while the CO₂ concentration in the atmosphere has risen to nearly 390 ppm.

Advanced computer models are used to project future climate change. The models attempt to cover as many relevant physical processes as possible and combine coupled general circulation models for the atmosphere and oceans with those for ice on land and sea. By applying such models to a number of different emissions scenarios, the IPCC projects an increase in average global surface warming of between 1.1 and 6.4 °C by the end of this century.

**The mitigation challenge**

To minimize the risk of the dangers of climate change, the European Union (EU) and others have long advocated that any increase in global temperatures should be kept below 2 °C relative to pre-industrial temperatures. This will require a stabilization of greenhouse-gas concentration in the atmosphere at well below 450 ppm CO₂-equivalent.

With current global emissions trends, the 450 ppm goal is challenging. In a business-as-usual scenario, the International Energy Agency (IEA) predicts energy-related greenhouse gas emissions to rise strongly in the foreseeable future: By 2030, global primary energy demand will be 45 percent higher than today, with 80 percent of the energy mix still based on fossil fuels. Ninety-seven percent of the increase will take place in non-OECD countries. The IEA has warned that

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**Footnotes**

1) National science academies in major countries express support for IPCC’s results and conclusions.

2) Today’s CO₂-equivalent level is already around 445 ppm when five other anthropogenic greenhouse gases are included. However, fine particles in the atmosphere and ozone in the troposphere are believed to largely offset this additional heating contribution, resulting in an effective level of CO₂ concentration of around 387 ppm.
this scenario will lead to severe and irreversible damage to the climate.

Securing a global supply of affordable energy to meet ever-increasing demands without generating excessive amounts of greenhouse gases is a huge challenge.

McKinsey & Company has found a potential exists to reduce greenhouse-gas emissions by 70 percent by 2030 and that any increase in temperature can be kept below 2 °C.

The IEA has developed and analyzed a scenario that fulfills the 450 ppm stabilization target. This scenario requires strong and concerted action to curb the growing greenhouse gas emissions. It relies on successful international climate negotiations where all countries, especially major emitters, commit to cutting emissions. According to the IEA, even if the OECD countries were to reduce their emissions to zero, they cannot achieve the 450 ppm target by themselves.

The scenario predicts a 22 percent growth in primary energy demand until 2030, with 67 percent of the energy mix coming from fossil fuels alone.3) Energy-related CO2 emissions are cut by 37 percent compared with the business-as-usual scenario. As much as 54 percent of the savings come from energy-efficiency measures, while renewable energy and biofuels contribute 23 percent. Carbon capture and storage (CCS) and nuclear power are also important instruments in cutting emissions.

Transforming the energy system will require large investments: The IEA estimates an average cost of 0.55 percent of annual world GDP up to 2030. At the same time, improved efficiency levels will reduce both operational costs and energy bills.

McKinsey & Company has made an in-depth study of emissions reduction potential and cost of more than 200 technologies in 10 different sectors, covering all relevant sources of emissions (not only energy-related) in 21 different regions around the world.

Footnotes
3) Even in this scenario, fossil fuels maintain a dominating role for a considerable period of time.

Exhibit 1

Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below 60 per TCO2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

Source: McKinsey & Company
The company has found that a potential exists to reduce greenhouse-gas emissions by 70 percent by 2030 as compared to business-as-usual, and that any increase in temperature can be kept below 2 ºC. However, it is a huge challenge to capture enough of this potential since success relies on the implementation of almost all identified abatement opportunities. McKinsey has found that a 10-year delay in taking action against emissions would make it impossible to limit the temperature rise to 2 ºC. The annual mitigation cost by 2030 is estimated at 1 percent of the forecasted global GDP. In agreement with the IEA, it has found that future energy savings compensate for much of the up front investment.

Energy efficiency
In many countries, energy efficiency increased considerably after the oil crisis in the 1970s. Today, the production of a unit of GDP in developed countries requires 30 percent less energy than it did 1973. This is a result of productivity improvements and products that are more energy efficient and more intelligent. Energy efficiency improvements decreased during the 1990s because energy prices were low and stable, and considerable reductions in energy intensity had already been achieved. In cases where the cost of energy represents a minor part of a company's overall costs, it is easily forgotten when optimizing manufacturing processes and product performance.

Today energy efficiency is high on many agendas and its key role in the mitigation of climate change is universally recognized. The potential to save energy is everywhere in society: In the power sector, opportunities exist in the chain that connects generation to consumption. Energy use can be cut in commercial and residential buildings by providing better insulation and by controlling heating and cooling. Improved car fuel efficiency can also make a considerable difference. Huge savings can also be achieved in industry. According to a report from the IEA, almost a third of the world’s energy consumption and 36 percent of CO2 emissions are due to manufacturing. Industrial energy use has increased strongly over the last 25 years and about 80 percent of the growth has occurred in China. The IEA has identified potential savings of between 25 to 37 EJ (Exajoules) per year in the manufacturing industry if best practices and proven technologies are used. This corresponds to a reduction of 7 to 12 percent of present global CO2 emissions.

The European Union is a keen supporter of the UN process to manage climate change and has been implementing climate policies and regulations for some time.

Electrical motor systems offer the largest savings opportunity in the manufacturing industry. Optimizing motor systems can achieve yearly savings of between 6 and 8 EJ, which is equivalent a quarter of the world’s total nuclear power production. The use of high-efficiency motors, variablespeed drives to control motor speed and adequate motor protection to permit downscaling of motor sizes are some of the means of achieving these savings.

Negotiations and climate policies
This year, governments around the world are busy preparing for COP-15, the United Nations (UN) climate conference, which will be held in Copenhagen in December. According to the Bali Action Plan established at COP-13 two years ago, governments are destined to agree on a new and ambitious global treaty to succeed the Kyoto agreement by 2012. Key points that will be addressed at COP-15 include:

- The amount of emissions reduction that developed countries must commit to and how this is to be financed.
- The reasonable mitigation actions for developing countries, especially China and India.
- The possibility of reaching a credible agreement on the stabilization of greenhouse-gas concentrations in the atmosphere at 450 ppm CO2-equivalent or less.

The success of COP-15 depends on finding acceptable compromises on these issues and on reaching an agreement. However, even without a new global agreement, countries and regions are already taking action by implementing policies and regulations to curb emissions.

The European Union (EU) is a keen supporter of the UN process to manage climate change and has been implementing climate policies and regulations for some time. Its main tool is the cap-and-trade system, EU ETS, which puts an absolute cap on 50 percent of all emissions in the EU. Twelve thousand industries and power plants within the EU have obligations in the system. The EU's 20/20/20 plan sets out targets for 2020, including:

- Cutting CO2 emissions by 20 percent compared with levels in the 1990s. This figure will increase to 30 percent if a global agreement can be reached.
- Increasing the share of renewables in the energy mix to 20 percent.
- Cutting primary energy use by 20 percent through efficiency measures.

Footnotes
1) 1 Exajoule (EJ) = 1018 joules
2) An 18 to 26 percent increase in energy efficiency
The US administration has indicated that it aims for an agreement in Copenhagen, including binding commitments to reduce emissions. The administration’s New Energy for America plan aims to:

- Cut emissions to the levels seen in the 1990s by 2020 and by 80 percent by 2050.
- Have a million plug-in hybrid cars on the road by 2015.
- Ensure that by 2012 10 percent of power comes from renewable; this figure will increase to 25 percent by 2025.
- Introduce an economy-wide cap and trade program.

China embraces the principle of common but differentiated responsibilities established in the Kyoto protocol, which says that developed countries should take the lead in reducing greenhouse-gas emissions as well as providing financial and technical support to developing countries. However, some signs indicate that China may be ready to relax its resistance against controlling its emissions and is interested in reaching an agreement in Copenhagen. China launched its National Climate Change Program two years ago, which includes the challenging target of cutting energy intensity by 20 percent by 2010. China also aims at doubling its share of renewable energy use by 2020. Another ambitious program aims at cutting energy use at China’s top 1,000 enterprises.

**ABB's contribution**

The mitigation of climate change is a long-term issue that will call for significant changes in the way industry and society at large produce and use energy and electricity. Success will require changed consumer patterns as well as the development and deployment of new technologies on a large scale.

ABB has a two-year rolling target to reduce its use of energy per manufactured unit by 5 percent. During 2008, ABB increased its production output by 20 percent while its total use of energy remained relatively unchanged. This was due to energy efficiency programs initiated throughout the group. Typical measures include better climate control, more efficient lighting and the installation of energy efficient manufacturing equipment in factories and offices. This has resulted in impressive results from all over the world: for example, the electricity intensity at ABB China has fallen 55 percent over 5 years.

In 2008 ABB’s installed base of low-voltage variable-speed drives saved an estimated 170 terawatt-hours of electric power, enough to meet the annual needs of 42 million households in the EU.

ABB will make energy audits and establish relevant energy-efficiency improvement programs for each of the 23 ABB manufacturing sites that consume more than 1 percent of the total group energy consumption.

In addition, ABB is committed to helping its customers use energy more efficiently and reduce their environmental impact with its broad array of products, systems and services. For example, the company’s advanced information technology systems for the control and optimization of integrated industrial processes, electrical power grids and buildings save energy and reduce emissions.

The interconnection and strengthening of power systems with high-voltage direct current (HVDC and HVDC Light®) technology and flexible AC technologies (FACTS) make large savings through a more even distribution of loads, an efficient use of primary energy resources and increased power quality, thereby reducing CO₂ emissions. It also enables large-scale integration of renewable energy into the power grids.

ABB's high-efficiency motors and variable-speed drives for motors also contribute to large emission reductions. In 2008 ABB’s installed base of low-voltage drives saved an estimated 170 terawatt-hours of electric power, enough to meet the annual needs of 42 million households in the EU and reduce global carbon dioxide emissions by some 140 million tons a year.

For ABB climate change is a huge opportunity and challenge: ABB must continue to live its slogan “Power and productivity for a better world” and continue to serve its customers with present and new technologies that meet increasing market demands on energy savings and climate efficiency in the long-term.

**Anders H. Nordstrom**
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The electricity industry is driven by a number of different forces, and it faces a series of challenges that will change the way that electrical energy is produced, distributed and used. With demand growing at a constant rate and with most of that growth taking place in developing countries, the regional differences in the way electricity is used are likely to be accentuated. In the mature economies the aging infrastructure poses a challenge and the request for technologies that protect the environment and reduce the energy intensity is high. In the developing and fast-growing economies, the vast need for electrical energy drives huge investments in new infrastructure for generation, transmission and distribution.
Although the energy mix for power generation is not expected to change significantly, those countries that increase the amount of renewable energy in their mix will need to address grid reliability. Transmission and distribution grids in many parts of the world are operating close to capacity and although new grids are being built in the rapidly growing Asian economies, they are not being built fast enough to meet the escalating demand. To reduce local energy shortages or provide a better optimization base for utilities, either inter-connections between grids will be necessary or other local resources for generating electricity have to be promoted.

The top priority for all countries will be to ensure a reliable supply of electric power. The cost involved in refurbishing grids and new grid installations is a major challenge. This challenge is getting harder for the equipment manufacturer due to the shortage of materials used and the fact that ageing assets require more and more maintenance. To reduce operating costs and increase output there will be a tighter focus on minimizing power losses and on changing the way energy is used and marketed.

Political drivers
In most emerging economies and in some mature economies, the demand for electricity increases in relation to growing gross domestic product (GDP) per capita. Governments attempt to keep pace by providing a functioning electrical infrastructure that can extend over vast geographic expanses, as in China and India, or across national borders, as in Africa or the Middle East.

In mature economies, investment in power networks consists mainly of bottleneck removal and network improvements to secure supply reliability and prevent blackouts. Deregulation was introduced to encourage investment in electrical infrastructure. This has not materialized, with the result that an imbalance exists between lacking generation capacity and increasing consumer demand in many parts of the developed world.

The fact that critical applications like hospitals, the manufacturing and process industries, and Internet and telecommunications infrastructure are dependent on electricity makes supply reliability a priority for many countries. Whether the primary energy sources are nuclear power, wind energy or coal, for example, in those cases where generation and consumption are not collocated, countries must trigger investment in the transmission and distribution network to facilitate the delivery of larger volumes of power.

The top priority for all countries will be to ensure a reliable supply of electric power.

Network interconnections are driven by several key political factors. First, the need for supply security is strongest in those countries where there is a shortage of power generation resources. Getting connections to other grids could help. Second, interconnections make it possible to stabilize a national grid without making a major investment by using foreign capacity reserves. And third, interconnections in some large political structures like the European Union are a logical consequence of the political integration of neighboring nations.

Different regions prioritize different aspects of the environment. While the presence of distribution lines in the streets of towns and cities is not acceptable in Western Europe, it is not an issue in the United States and other parts of the world. For transmission lines the issue of the “right of way” is significant. The regularity and effects of

Footnote
1) See “Transport or transmit?” on page 44 of this edition of ABB Review.
blackouts – as in Europe in 2003 – have triggered a political debate about the reliability and robustness of electricity networks. In some countries new legislation is imposing heavy financial burdens on utilities that fail to deliver power to consumers; in others, utilities have made agreements with large industrial consumers to shed load in overload conditions in order to secure network stability and prevent large-scale blackouts.

Attempts to control the power factor of industrial and electrical equipment are also making progress. Legislation, energy taxes and information campaigns have all influenced customers into selecting variable-speed drives and high-efficiency motors, and consumers into choosing energy-efficient home appliances [1].

**Economic drivers**

Strongly connected to economic growth, especially in the rapidly emerging economies, is the demand for electrical energy. The International Energy Agency (IEA) estimates that net electricity consumption in the emerging economies will grow at an average rate of about 4 percent a year between 2007 and 2030 2. In contrast, demand in the mature economies is predicted to rise by an average of 1.5 percent a year, and in the transitional economies of Eastern Europe and the former Soviet Union (EE/FSU) by an average of 3.1 percent. China and the United States are expected to lead the projected growth in consumption, adding almost three and two billion kilowatt hours, respectively, to their annual net consumption levels over the 23-year period 3.

Predictions for growth in net consumption in the emerging economies are based on projected increases in GDP and population. GDP growth in turn is dependent on access to reliable supplies of electricity. Because of the connection between reliable electricity supply, GDP growth and rising living standards, many emerging economies are making efforts to increase the capacity and reliability of their power networks.

In China and India this is leading to the construction of new power plants in remote locations close to primary energy sources. New transmission lines with the capacity to deliver large volumes of power are therefore required 2).

In the United States strong economic growth throughout the country is increasing the need for more generating capacity, mostly provided by upgrading existing plants. Demand for power is particularly strong in the commercial sector where average increases of 2.4 percent a year are offsetting efficiency gains in electrical equipment. Growth in the industrial and residential sectors is expected to be moderate.

Western Europe and Japan are expected to have the slowest growth in demand at 0.4 and 0.6 percent, respectively, in the residential sector, and 0.8 and 0.9 percent, respectively, in the commercial sector. Static or slightly declining population levels, expansion of information and communication technology (ICT) infrastructure, and the switch to economical heating and cooling devices are the main reasons for the flat demand curve.

The vast growth in demand for electrical energy is expected to continue over the next two decades and is estimated to require an investment of $10,000 billion in new electrical infrastructure, about half of which is needed for transmission and distribution systems.

**Many emerging economies are making efforts to increase the capacity and reliability of their power networks.**

In mature economies the tendency is to get as much energy as possible out of the existing system. Building new transmission lines is difficult for a variety of reasons, an important one being the “right of way” issue. There is little incentive for utility companies to invest in transmission and distribution infrastructure, as long as the investor is not the one who profits from the investment. It is more economical for them to squeeze more capacity out of existing assets.

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Footnote

2) See “Transport or transmit?” on page 44 of this edition of ABB Review.

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![World electric power generation by region (Source: IEA World Energy Report 2007)](image1)

![Projected growth rates in electricity generation for OECD and non-OECD countries (Source: IEA World Energy Outlook 2007)](image2)
A shortage of electricity in periods of high demand can lead to brownouts or blackouts. A recent study by the Union for Coordination of Transmission of Electricity (UCTE) in 2005 estimates that in 2015 there will be insufficient reserves of electrical power in all European countries. The report assumes that current plans to increase generating capacity will be implemented. The most economical solution to an energy shortage is to import power from a neighboring country. Connection to an adjoining grid is an efficient way for a country to stabilize its grid if spinning reserves are insufficient.

In mature economies there is a tendency to take electricity supply for granted. This was given a severe blow in 2003 when a series of widespread and high-profile blackouts drew attention to the vulnerability of electrical infrastructure. It led to the realization that there is a need to replace or upgrade ageing assets on a large scale in the short to medium term.

There was a similar wake up call in China. Three-quarters of the electricity consumed in China is used for manufacturing and heavy industry. When power shortages occurred in the summer of 2004, some 6,400 industrial plants in Beijing alone were shut down for a week and their operations staggered for the duration of the summer to avoid consumption peaks. Unless investment in electricity infrastructure keeps pace with demand, shutdowns and rolling blackouts could have a significant and detrimental effect on the country’s economy.

China’s 11th five-year plan targets an increase in generating capacity of 570 gigawatts by 2010. This is equivalent to an increase of roughly eight percent a year and will require annual investments of $20 billion to $30 billion. It appears, however, that building more power plants will not solve all of China’s electricity problems. Equally important is the construction of transmission lines to link the plants to consumers. The State Grid Corporation of China estimates that investments of $10 billion a year will be needed to expand and upgrade the country’s power transmission grid.

Some countries have introduced penalties for utilities that fail to meet demand. In Sweden, electric utilities have to compensate households with a sum equivalent to approximately one month’s electricity consumption for every day that the household is without power. This is a strong incentive for utilities to improve grid reliability.

Many utilities now see reliability as one of their most pressing concerns. The impact of poor reliability on society as a whole can be crippling. The blackout on August 14, 2003 in the United States is estimated to have incurred costs and lost revenues of $7 billion to $10 billion, and is attributed, as are most large-scale blackouts, to under-investment in transmission and distribution capacity and the use of outdated technology and simply wrong operation procedures.

Like reliability, the quality of the power delivered is increasingly driven by economic considerations. Some industries, such as printing and petrochemicals but also hospitals and other critical systems, require high levels of power quality. A Nordic Council survey estimates that the damage caused by a voltage sag (50 percent, 200 ms) for an average industry is as high as $4.50 per kW installed. The demand for power quality is particularly strong in mature economies with extensive amounts of sensitive ICT infrastructure, but is likely to become a global issue in the decades to come.

Attempts to reduce system losses are also driven by environmental factors. Transmission and distribution systems tend to lose 6 to 7 percent of the electricity they transport. Approximately 70 percent of those losses occur in the distribution system, which is more extensive than the transmission system and operates at a lower voltage (losses in lines are inversely proportional to the square of the voltage, i.e., doubling the voltage reduces losses to a quarter of their original value). Losses of more than 30 percent are estimated for developing countries, although it is important to distinguish between technical losses and commercial losses (the latter cannot be accounted for and are usually due to illegal connections).

Technical losses are rarely above 20 percent. Technologies such as high-quality transformers and reactive power compensation can reduce them to 5 to 7 percent. High levels of commercial losses can be devastating for system operators: If they cannot collect revenues, they cannot generate sufficient capital for investment.
It is not only utilities that are keen to reduce losses. Electrical energy savings have a direct impact on the bottom line of industrial plants, commercial businesses and households. This drives the demand for energy efficient electrical equipment like motors, drives and consumer appliances.

Electrical energy savings have a direct impact on the bottom line of industrial plants, commercial businesses and households.

The market naturally expects the cost of new grids and grid components to be as low as possible. With the price of raw materials like copper rising, their replacement with low-cost or better alternatives is an ongoing issue. Similarly the replacement of hazardous materials and the avoidance of penalties or taxes for excessive greenhouse gas emissions are strong economic drivers.

**Technology drivers**

Many new technologies, especially those for ICT devices and systems, require substantial amounts of energy. The growing number of new consumer products and more powerful home computers also use large amounts of electrical energy. In Germany, the estimated energy requirement of ICT devices is expected to grow by about 4 percent a year and account for 11 percent of the country’s energy consumption in 2010.

New technologies for industrial and commercial applications like integrated heating and cooling systems in buildings, improved battery technology for hybrid vehicles, and the widespread introduction of high-speed trains will increase the demand for efficient electric power. Technological developments in wind power will change energy flow patterns in grids, as will new types of power generation on the low-voltage side and large scale wind farms.

Progress in static var compensation and power storage technologies will enable new sources of electrical energy to be connected to existing grids. New types of batteries that are more compact than conventional lead-acid technology are already making an impact. For instance, the 40 MW battery at Fairbanks, Alaska, provides backup power for up to seven minutes for a community of 80,000 people [2]; and a new compact lithium ion substation battery with greater capacity and reliability is operating successfully in a pilot installation in Sweden. These installations are rather the exceptions and did not find a wider application so far. Flywheels, compressed air, pumped hydropower or compressed air storage are other means of storing energy through conversion.

Another energy storage method is hydrogen. Electricity is supplied to an electrolyzer, which divides water into hydrogen and oxygen, its two constituent parts. The hydrogen can then be stored and reconverted into electricity by fuel cells when needed. The overall efficiency of this storage method is currently rather low at about 25 percent. It remains to be seen whether hydrogen will replace electricity as a better means to transport energy. Major progress in the technology is not expected within the next few decades.

Phase-shifting transformers and series compensation are long-established methods for increasing power transfer in electrical grids. Power electronics have made it possible to control grids and new FACTS (flexible AC transmission systems) are improving controllability [3]. New
concepts like the unified power flow controller (UPFC) and the variable frequency transformer (VFT) have to show their customer acceptance yet. Monitoring systems like phasor measurement units are slowly being installed in power networks, which will, when fully deployed, increase the possibility of operating a system close to its limit [4].

New technologies will also improve maintenance. The switch from oil-based to dry insulation and from spring drives to electrical drives in circuit breakers are examples, as is the introduction of information technology into maintenance processes. Online analysis of primary equipment such as transformers is facilitated by software that assesses the condition of the equipment in real time. Risk analysis software for the preventive maintenance of critical grid components is also available and under continuous development [5].

Technologies that save energy or improve efficiency are becoming more widespread [6]. Low-loss and energy efficient power semiconductors are reducing losses in the grid, and material processing like laser-cut sheet metal for transformers and improved material properties may result in additional efficiency gains. Traditional light bulbs are being replaced by electroluminescent lighting and more recently by bright LEDs. And continuous reductions in energy loss are being achieved by advanced motors and power-electronics-based variable speed drives.

The use of superconducting materials is another way to reduce losses in power grids. Research laboratories are making progress and there are now several types of superconducting materials available, of which magnesium diboride is a recent addition. Efficient cooling and an interface with existing 400 kV/ systems (a low-voltage/ high current system to a high-voltage/ low current system) and improved system characteristics will have to be developed before real progress with superconducting transmission can be made.

Compact circuit breakers and gas-insulated switchgear have reduced substation footprints and made it possible to build substations indoors – important factors in urban environments and mega cities where space is expensive and in short supply [7]. By replacing oil-paper insulation with cross-linked polyethylene (XLPE) insulation, the viable length of AC cables has increased by a factor of two and made underground high-voltage direct current (HVDC) cables economical for long distances [8].

New HVDC technology reduces the footprint of existing HVDC by a factor of three [9]. This is especially important for applications where space is critical. Some electrical equipment footprints are determined by the noise level they inject into the environment. New technologies have reduced noise in shunt reactors by 15 dB in the last 20 years.

Technical progress with new materials makes for better applications. Dry materials like XLPE are replacing oil and other wet materials; they reduce the risk of fire and enable equipment to be located closer to buildings. The standard epoxy resin commonly used as insulating material is being replaced by modern thermoplastics that bring more flexibility into manufacturing.

Information technology has opened up new ways for electricity to be traded as a commodity. Utilities are equipping households with meters that measure hourly consumption, and hourly trading is on the agenda to enable consumers to buy the cheapest, greenest or locally produced power. Research and development initiatives on “smart” or “self-healing” grids that improve supply reliability are also driven by advances in information and communication technology [4].

Prepared for the future
ABB, as a technology and market leader for all the issues discussed here, is very well positioned to contribute cutting-edge technology to the world’s major energy challenges. ABB’s local presence in all the markets gives customers the valuable advantage of fast and focused service. ABB works together with its customers to find the best solutions tuned to their local needs and to develop systems that work effectively across borders, whenever global approaches are appropriate.

Bernhard Jucker
ABB Power Products

Peter Leupp
ABB Power Systems

Tom Sjökvist
ABB Automation Products

Footnote
3) See “Substation evolution” on page 34 of this edition of ABB Review.
4) See “When grids get smart” on page 44 of this edition of ABB Review.

ABB Review Special Report Motors and Drives (2004), 1–64.


### Power and productivity for a better world

ABB’s broad energy-efficient product portfolio in power and automation technologies can achieve substantial savings and reduce emissions, contributing to global efforts on climate change mitigation and energy efficiency along the entire energy value chain.

<table>
<thead>
<tr>
<th>Image</th>
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| ![Global shipping](image1.png) | - The global shipping industry handles 300 million containers every year, producing 521 million tons of CO₂ compared with aviation’s 400 million tons. Container ships are an important market for ABB turbochargers, which cut fuel consumption by up to 10 percent and reduce emissions.  
- ABB Azipod® propulsion systems help cruise and cargo vessels save more than 135,000 tons of fuel annually. |
| ![Industry](image2.png) | - Motors consume two-thirds of this electricity. Less than 10 percent of the world’s electric motors are equipped with variable-speed drives. ABB’s installed base of drives saves about 130 million megawatt-hours of electricity per year, equivalent to 16 nuclear reactors.  
- ABB’s variable-speed drives can reduce energy consumption by more than 50 percent. |
| ![Global energy](image3.png) | - Energy efficiency can reduce the growth rate of energy demand by half. In the EU, inefficiencies in the transmission and distribution of electricity resulted in losses of up to 10 percent in 2005.  
- Using ABB direct current transmission technology cuts energy losses by up to 30 percent over long distances. |
| ![China](image4.png) | - Countries differ widely in energy productivity. Huge improvements can be made using existing technology.  
- The potential for energy efficiency is greatest in emerging markets, where ABB is the leading provider of power and automation technology. |
| ![Wind](image5.png) | - The 20,000 MW generated by wind turbines added globally in 2007 will generate as much electricity as 29 coal-fired power stations.  
- ABB is the world’s largest supplier of electrical products and services to wind turbine manufacturers. ABB’s wind power business grew more than 50 percent a year between 2003 and 2006. |
Seeking continuous improvement

Energy efficiency is a core element of ABB manufacturing processes and products. This enables ABB to help customers to use electrical power effectively and increase industrial productivity in a sustainable way.

The link between energy efficiency and mitigating climate change is clear. According to a recent study by the International Energy Agency, 80 percent of projected CO₂ emission reductions by 2030 will be delivered through energy efficiency. ABB recognizes the issue’s importance. A significant proportion of ABB’s revenues come from products that increase customers’ energy efficiency.

ABB’s strategy through to 2011 identifies environmental concerns as a key driver of market growth.

All industrial activities have varying degrees of environmental impact caused by emissions, waste, and the use of energy and materials that result in pollution and depletion of natural resources. ABB has been working for many years to reduce these impacts, both within its own plants and offices, and those caused by its products. As part of these efforts, ABB now uses less material and energy, streamlines its means of transportation and is making increased efforts to design products that can be recycled.
ABB backs
global sustainability efforts

ABB is working with utilities and international business groups to find ways of protecting the environment while sustaining economic growth.

In 2006, ABB joined Swedish utility Vattenfall and other energy-related companies in a business leaders’ initiative to combat climate change with a global agreement to limit emissions and stabilize the global rise in temperatures.

ABB is a member of the World Business Council for Sustainable Development, a coalition of 180 international companies founded in 1995, and is also one of 40 companies on the Business Environmental Leadership Council of the Pew Center on Global Climate Change.

The groups are looking for ways to solve the conundrum of helping people in the developing world raise their living standards while slowing emissions of greenhouse gases that have induced climate change.

Energy and climate change study

ABB’s engagement is helping to support research such as the World Business Council’s 2005 study on energy and climate change. Using more natural gas instead of coal and oil is one of the three main options for restraining emissions identified in the report.

Another is switching to forms of energy that don’t produce carbon dioxide and that are in unlimited supply, such as wind or the sun. Energy conservation and efficiency is the third path.

“It will take years, if not decades to create substitutes for current fuels, but there are many things we can do today,” said Peter Terwiesch, chief technology officer at ABB. “Using today’s state-of-the-art technologies we can significantly upgrade the efficiency with which we generate, transmit, distribute, and use electricity.

“Not only does that lead to immediate conservation of precious fossil fuel resources and to lower emissions, it is also typically a much better economic return compared to adding new generation capacity, or to continuing to pay high energy bills. This is why at ABB, we often talk of energy efficiency measures as the other alternative fuel.”

Global price for emissions

ABB and the companies that have signed up to Vattenfall’s initiative on climate change are pressing for the introduction of a global price for emissions of greenhouse gases so that these can be traded worldwide with minimal impact on competitiveness.

They are also urging governments, producers and customers to be open to new solutions and technological developments to ensure the most efficient use of resources and that the options are not limited to those now available.

The last word

Energy is essential to life and its conservation has become an absolute necessity. In context of the growing importance of energy conservation, the editorial team of CONTACT has brought together a special supplement on energy efficiency.

Depletion of fossil fuels, rising energy prices and concerns about climate change have brought the topic of energy efficiency in the mainstream of business and public agenda and ABB is aligned to this cause. Our energy-efficient products and technologies help customers across utilities and industries improve their processes and enhance performance to optimize energy consumption.

We hope you find the special issue relevant and useful.

We look forward to your comments and feedback.

Deepak Sood, Head, Communications, India
Increasing energy efficiency by 25%?

A complete power and automation solution from ABB has helped the largest aluminium refinery in Europe to increase its energy efficiency by 25 percent, boosting productivity at the same time. With research and development geared toward improving performance and resource conservation, we’re constantly working to save energy and money. And the environment. www.abb.co.in/energyefficiency

Certainly.
Power and automation technologies from ABB

ABB technology improves control over electricity, enabling power networks to be more reliable, more efficient and more accessible to renewable energy.

Energizing and controlling power plants

Power plant operators aim to run their installations at the highest possible level of efficiency, regardless of the energy source. With more than 125 years of experience and a vast installed base, ABB offers technologies for complete electrical and automation solutions as well as controls and instrumentation products for power generation plants of all kinds.

Power transmission

ABB is a pioneer and market leader in technologies for efficient and reliable transmission of power over long distances with minimal losses. Our ultra-high and high-voltage solutions up to 1000 kV, including HVDC Light, FACTS and cable systems, help transport power and connect transmission grids over land, underground and even underwater.

Substations

Transmission and distribution substations enable power transfers with a range of high and medium voltage products that ensure reliability and efficiency, such as surge arrestors, protection equipment, switchgear and circuit breakers. Transformers adjust voltage levels higher or lower for a vast range of purposes, while special automation systems protect and optimize the flow of power within a substation.

Managing the network

A network management system integrates all data from hundreds of thousands of points in a power network. Systems like network control, SCADA (supervisory control and data acquisition) and utility management solutions, ABB's knowledge of installed equipment, switchgear and circuit breakers. Transformers adjust voltage levels higher or lower for a vast range of purposes, while special automation systems protect and optimize the flow of power within a substation.

Services

With a global installed base of more than 100,000 customers, ABB services offering encompasses the entire value creation chain, from consulting, project execution, installation, maintenance and services to complete asset management solutions.

Plant electrification and energy management

ABB automation systems increase productivity, improve energy efficiency and keep workplaces safe. Our systems reduce production costs with better scheduling, execution and management of electrical energy, such as intelligent distribution and management, and remote monitoring and control.

Process automation and data acquisition

ABB's control systems increase energy efficiency in field pumps, compressors, conveyors, filters, centrifuges, valves, actuators, motors and fans. Field, cost-effective, ABB automation solutions control and optimize processes, leaving you free to work on more important things.

Material handling and robotics

ABB robotics and drives increase energy efficiency in fields ranging from materials handling, and process automation, to assembly, automotive, electronics and materials handling. ABB robotics are world leaders in flexible, high-tech robots.

Protective and control systems

ABB protective and control systems protect people, buildings and equipment from electrical overloads. ABB low-voltage products, ranging from switchgears, enclosures and cables, systems, control and monitoring to medium-voltage switchgear, are fully integrated with ABB intelligent building automation, energy management, control and monitoring systems.

ABB technology delivers better quality with greater speed and flexibility, and lower environmental impact.

CONTACT

ABB services help customers improve the performance of automated systems and equipment. Life-cycle services provide predictive, corrective and corrective maintenance and continual evolution of optimized automation systems. ABB services help customers use fewer energy, enhancing process efficiency and reliability. Full service contracts put ABB in charge of engineering, planning, and managing plant maintenance activities.