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technology solutions

Corporate technical magazine of the ABB Group in South Africa and the sub-Saharan Africa region

Painting South Africa's energy landscape for 2025


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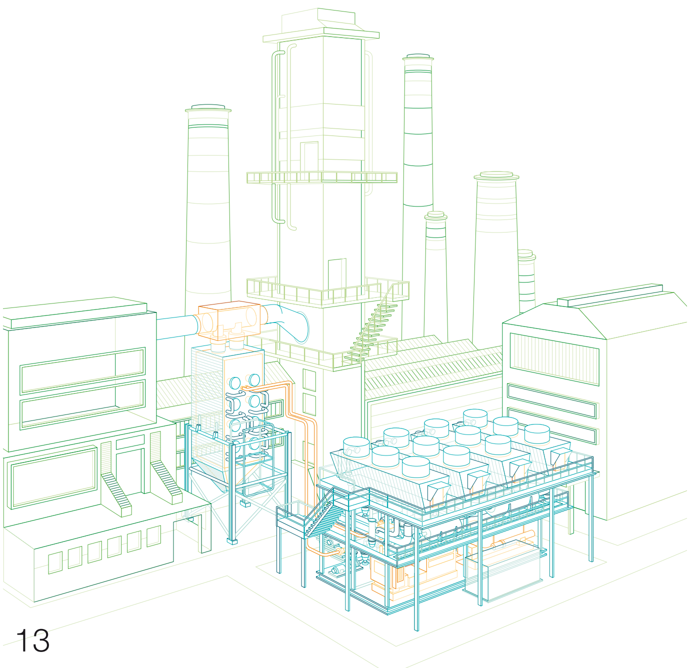
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Smart technology

Existing electric power grids were not designed with today's latest technology. They were not built to support a power-hungry, high-tech economy with greater energy efficiency and carbon emission reduction requirements, or to incorporate renewable energy.

Future electricity demand, according to the forecast of the International Energy Agency, means that we will need to add a 1GW power plant and related grid infrastructure every week for the next 20 years. Many grids around the world require upgrading as they experience costly power outages and power quality disruptions, are inefficient at managing peak loads, do not support high-volume information flows and are not geared to handle higher levels of renewable energy and distributed generation.

The term smart grid has been used often in the last few years in the electric power industry to describe a digitised version of the present day power grid. Smart grids can be achieved through the application of existing and emerging technologies. However, it will take time and many technical and non-technical challenges need to be overcome.

In South Africa, the future electricity infrastructure should become clearer later this year when the Integrated Resource Plan 2 (IRP2) will be published. The IRP2 is a medium- to long-term plan that will direct the expansion of the electricity supply over the next 25 years.

It is clear that demand for electricity is expected to rise and the government wants to include an increased mix of renewable energy as part of its Long Term Mitigation Scenarios (LTMS) plan. Increased generation capacity will require strengthening of the transmission network and the ageing distribution infrastructure.

In this issue of Technology Solutions, we speak to Thembani Bukula, the official primarily responsible for electricity generation at the National Energy Regulator for South Africa, who provides insights into the country's electricity demand and the power grid of the future (see page 5).

South Africa's power capacity is expected to increase, depending on demand, from 42 000MW to about 62 000MW (at an estimated low 3% per annum GDP growth rate) by 2025. An increase on such a scale will require increased transmission and distribution infrastructure with higher levels of grid reliability.

The regulator is aware that such orders of magnitude in the system and complexity with distributed sources of power mean that the grid of the future will need a high level of automation. For both transmission and distribution networks, stability and reliability will be critical.

ABB has been at the forefront of smart grid technology development since long before the term was coined, and has available wide area monitoring systems (WAMS), SCADA (supervisory control and data acquisition) systems, FACTS (flexible alternating current transmission systems) devices and HVDC (high-voltage direct current) systems (see article on page 7, which discusses some of these technologies). ABB has already implemented many of these technologies in power grids around the world.

In May, ABB agreed to acquire Ventyx for more than $1-billion from Vista Equity Partners, to become a leading provider of software solutions for managing energy networks. One of Ventyx's key software applications enables a practical business model for utilities to generate revenues from smart grids and carbon trading.

Recently ABB announced that it will work on a joint development project with Helsingin Energia, a public utility in the Finnish capital of Helsinki, and Nokia Siemens Networks to design and install a large-scale smart grid in the new Kalasatama district of Helsinki. The solutions include ensuring that excess power generated from renewable energy sources can be fed into the power grid, enabling electric vehicles to draw electricity from the grid or feed it back and helping to lower consumption and emissions.

High levels of research and development investment are required for companies such as ABB that are able to offer technology to design and build smart grids. Despite the economic recession, ABB will continue to invest more than $1-billion on research and development in 2010 alone. Last year, the group invested $1.3-billion, up from $1.2-billion in 2008.

Carlos Poñe.

By implementing the smart technologies that ABB has to offer, the power grids of the future will be more reliable and stable and be better able to handle the complexities of a power system that will need to integrate power generation from a variety of sources – such as from private power producers and small and large renewable energy plants.

The idea of a smart grid seemed futuristic even five years ago. But with increasing electricity demand worldwide and the anticipated complexity of power grids because of renewable energy sources, preparation for implementing smart technologies is already happening in both developed and developing economies. South Africa can be a model of what is possible in smart grids in a developing country if the planning for the future begins now.

Carlos Poñe
CEO
ABB South Africa

Painting South Africa's energy landscape for 2025

The energy regulator provides a glimpse of how the energy sector could develop in the years ahead.

The official primarily responsible for electricity generation at the National Energy Regulator for South Africa, Thembani Bukula, takes the long view – in some cases 20 years ahead – when he envisions the southern African energy landscape beyond the 2010 World Cup.

Setting long-term oversight are the energy sector's integrated resources plans (IRPs) – 20-year programmes that are revisited every three years via multi-year price determinations (MYPDs), which take into account a shifting financial regime and other developments and allow for adjustments. The IRP sets the policy for the period, leaving space for innovation – such as a smart grid that is under active consideration – that might change the composition of the energy mix and costs.

Bukula concedes that generation demand is closing in on supply to an uncomfortably narrow degree.

"We are close to meeting our demand and that situation is not desirable," he says. "When we do our load forecasting in the integrated resources plan, in this case the IRP2, and we assume an electricity growth of around 3%, then by 2025 we would require an additional 20 000MW onto the system to move our installed capacity from 42 000MW to 62 000MW. About 10 000MW of this could come from external projects in neighbouring countries. Most are at conceptual stage although some have gone through pre-feasibility."

This means that an assumed medium economic growth rate of 4.6% by 2025 calls for a doubling of the current installed generation capacity – to at least 80 000MW.

"And once you have the desired capacity you need the cables to distribute it, and that means that if we double the capacity we have to double the amount of transmission lines and distribution cables as well," says Bukula. "At the moment we have around 26 000km of transmission lines only and more than 50 000km of distribution lines."

By doubling the country's energy output the distribution network must double as well to 100 000km – which is Johannesburg to London and back five times! That is the macro picture, but not all of it. It gets even more mind-numbing.

A distribution makeover of such staggering proportion also presents opportunities that stretch the mind.

At the moment we have around 26 000km of transmission lines only and more than 50 000km of distribution lines.

"One such is a smart grid that totally out-thinks the one we have now," reports Bukula. "The present system carries power from point to point. We now envisage a smart grid that can understand that power will flow from different sources and is smart enough to accept renewable energy, for instance, and not reject it as is the case with the current system."

That means that in the next decade South Africa will have distributed energy of renewable generation such as solar or wind through a grid capable of accepting a generation mix that might constantly change – "because the wind blows when it wants to, and the grid must understand that and deal with it", Bukula points out.

Much smart grid technology is at the development stage but, "it is one of those technologies that South Africa does not have the luxury to wait for. We all have the same challenges."

The electricity South Africa will generate will need transmitting, and distribution will add to the complexity of the country's energy makeover. "The number of substations we'll have to build is enormous. Even if we only upgrade the current ones to take up the load and accept generation from different points, the level of automation required has to be grand," says Bukula. "The new grid must be capable of making up its own mind, reading the situation and reacting accordingly, rather than waiting for an operator to tell it what to do. That's what a smart grid is. So, going forward, the upgrade of the network's automation must enable it to see what the current network does not, on a scale that we have never seen before."

The regulator believes that the efficient use of energy must be keyed into future strategies. "The cheapest megawatt is the one that has not been generated," he says, "so efficiency means you are not generating the unneeded megawatt. Much depends on how effectively we can change human behaviour."

Soon South Africa must also decide on the generation mix it sees down the line. Even with prodigious use of it, the country and those around it are endowed with more coal than can be burnt in the next couple of centuries. But for many concerned with fossil fuels' harmful effects, the sooner coal is phased out the better. "Leave it in the ground so it can become diamonds one day," is the green view.

Excluding hydro, because of scarce and unreliable water flows, South Africa can look to plenty of other readily available renewable energy sources – within the confines of the cost bogey.

"The South African generation mix must evolve alongside its affordability," says Bukula. "And we must accept for now that coal is still one of the cheapest, even taking carbon taxes into account. By adding other technologies, the current 42 000MW moves close to being fully depreciated, making the average price in next three years still below 60c.

Thembani Bukula.

"The blend over the years must be done in a way that ensures the price of electricity remains affordable," cautions Bukula. "The blending must be such that the difference between the two is not the 10 times it is now, and not more than twice or three times as much."

A reasonable scenario to assume as the outcome of the IRP2, due for release by end-September this year, is that by 2025 South Africa would have succeeded in generating an additional 40 000MW – 40% from coal, 40% from nuclear and 20% from renewable resources.

"Of course, that might change," acknowledges the regulator. "In five years time, the silicon used in photo-voltaic manufacture might suddenly drop in price and storage technology might significantly improve, making solar generation more affordable. This could tilt the scales for more emphasis on solar and less on coal, say. This would call for a change to the IRP, taking into account the realities as they arise."

Predicting the shape and financial profile of the energy sector in 2025 is a daunting task, as Bukula is the first to admit. Methods of generating, transmitting, distributing and storing energy, and its costs, are constantly being challenged and change is the only constant. **– By Tom Nevin**

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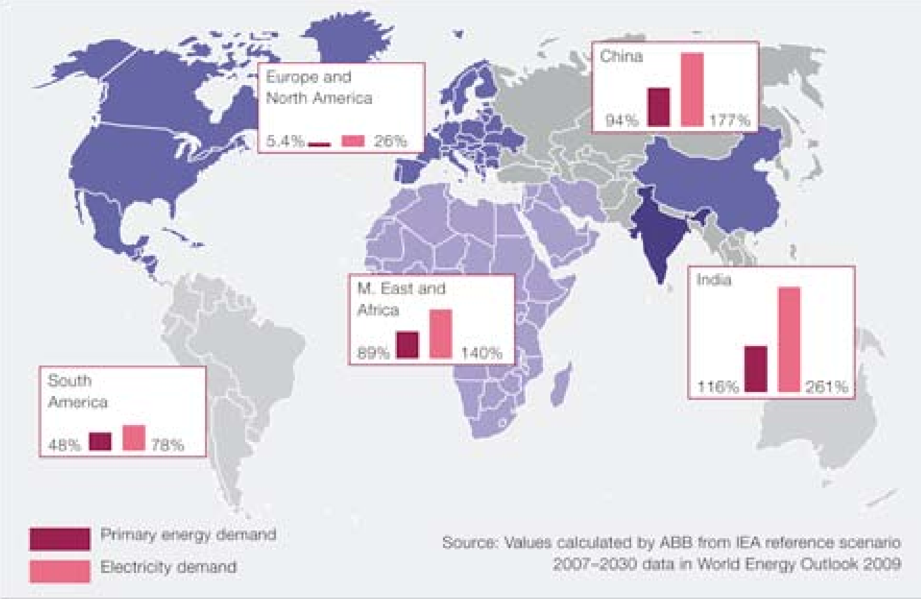
The next level of evolution

Smart grid technologies are key to supplying the world with high-quality, clean, reliable and sustainable power.

ENRIQUE SANTACANA, BAZMI HUSAIN, FRIEDRICH PINNEKAMP, PER HALVARSSON, GARY RACKLIFFE, LE TANG, XIAOMING FENG – Electrical power grids are critical infrastructures in all modern societies. However, many are ageing and are stressed by operational scenarios and challenges never envisioned when the majority of the grids were developed many decades ago.These grids now need to be transformed into smart grids in order to meet the challenges facing developed and developing countries alike, such as the growing demand for electric power, the need to increase efficiency in energy conversion, delivery, consumption, the provision of high-quality power and the integration of renewable resources for sustainable development. The term smart grid has been frequently used in the last few years in the electric power industry to describe a digitised version of the present-day power grid. Smart grids can be achieved through the application of existing and emerging technologies. However, it will take time and many technical and non-technical challenges – such as regulation, security, privacy and consumer rights – need to be overcome.

1 A demand growth comparison of primary and electrical energy.



At the National Governors Association Convention in the US in February 2009, the CEO of a major utility started his speech with the confession that he did not really know what the term smart grid[1] meant [1]. Shocking as it may seem, many others in the engineering community might have secretly been in the same boat.

The definition of a smart grid may vary, depending on where you are in the world. In the US, for example, the following attributes are commonly cited as being necessary to define a smart grid [2-6]:
– It should be self-healing after power disturbance events.
– It should enable active participation by consumers in demand response.
– It should operate resiliently against physical and cyber attacks.
– It should provide quality power to meet 21st century needs.
– It should accommodate all generation and storage options.
– It should enable new products, services and markets.
– It should optimise asset utilisation and operating efficiency.

According to a European Commission report [7], a smart grid in Europe is described as one that is:
– Flexible: It should fulfill customers' needs while responding to the changes and challenges ahead.
– Accessible: Connection access to all network users should be possible. In particular, the smart grid should be accessible to renewable power sources and high-efficiency local generation with zero or low carbon emissions.
– Reliable: This means the grid is secure and the quality of the supply is assured. It should be consistent with the demands of the digital age and resilient to hazards and uncertainties.
– Economical: The best possible value is provided through innovation, efficient energy management and a level playing field in terms of competition and regulation.

China, one of the most power-hungry economies on the planet, is also developing the smart grid concept. According to a memo issued by the joint US-China Cooperation on Clean Energy (JUCCCE) in December 2007, "the term smart grid refers to an electricity transmission and distribution system that incorporates elements of traditional and cutting-edge power engineering, sophisticated sensing and monitoring technology, information technology and communications to provide better grid performance and to support a wide range of additional services to consumers. A smart grid is not defined by what technologies it incorporates, but rather by what it can do" [8].

The need for smart grids

Electricity is the most versatile and widely used form of energy in the world. More than five billion people worldwide have access to electrical energy and this figure is set to increase. The level of electrical power consumption, reliability and quality has been closely linked to the level of economic development of a country or region. According to an International Energy Agency (IEA) forecast, the worldwide demand for electrical energy is growing twice as fast as the demand for primary energy, and the growth rate is highest in Asia. Meeting this rise in demand will mean adding a 1GW power plant and all related infrastructure every week for the next 20 years!

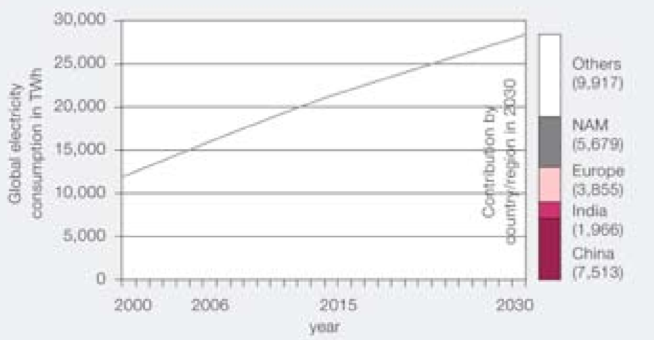
At the same time, an increasingly digitalised society demands high power quality and reliability. Simply put, poor reliability can cause huge economic losses. To illustrate this point, a Berkley National Laboratory report in 2005 stated that in the US the annual cost of system disturbances is an estimated $80-billion, the bulk of which ($52-billion) is due to short momentary interruptions. The reported number of system disturbances from 2002 to the middle of 2008 is shown in an accompanying graphic. In addition, the threat of terrorist attacks on either the physical or cyber assets of the grids also heightens the need for power grids that are more resilient and capable of self-healing.

The impact on the environment is another major concern. Carbon dioxide (CO_2) is responsible for 80% of all greenhouse gas effects and electric power generation is the largest single source of CO_2 emissions. The growth trend of annual CO_2 emissions (in gigatons) from electric power plants compared with the emissions from other sources is shown in a graphic here. Shockingly, more than 40% of the CO_2 emissions from power plants are produced by traditional power plants. To reduce this carbon footprint while satisfying the global need for increased electrical energy, renewable energy, demand response (DR), efficiency and conservation will be needed. However, the increasing penetration of renewable energy brings with it its own challenges; for example, not only is the uncertainty in the supply increased but the remote geographical locations of wind

Footnote

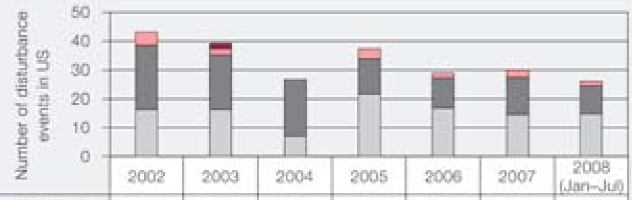
1 The term smart grid is sometimes interchanged with the terms intelligent grid, modern grid and future grid.

2 Global and regional electricity consumption.



Source: IEA reference scenario in World Energy Outlook 2009

3 Reported disturbance events in the US between 2002 and 2008.



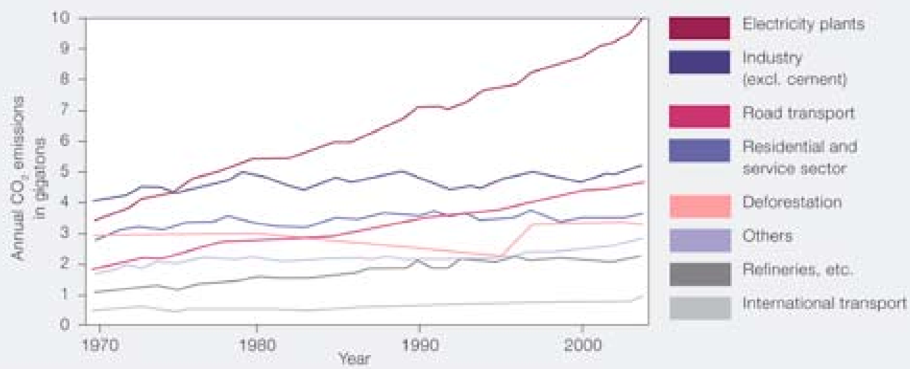
	2002	2003	2004	2005	2006	2007	2008 (Jan–Jul)
Category 5	0	1	0	0	0	0	0
Category 4	4	2	0	3	1	2	1
Category 3	22	20	19	12	11	13	10
Category 2	17	16	8	22	17	15	15

Source: NERC annual report 2008

farms and solar energy sources stress existing infrastructures even more.

These new requirements can only be met by transforming existing grids, which, for the most part, were developed many decades ago and have been showing signs of aging under increased stress. The growing consensus and recognition among the industry and many national governments is that smart grid technology is the answer to these challenges. This trend is evidenced by the appropriation – toward the end of 2009 – of more than $4-billion by the US government in grants to fund research and development, demonstration and the deployment of smart grid technology and the associated standards [9]. The European Union and China also announced major initiatives for smart grid technology research, demonstration and deployment in 2009.

4 Growing carbon footprint in which electrical power generation is the largest single source of CO_2 emissions.



Source: IPCC "Migration of Climate Change," Cambridge University Press, 2007

Smart grid challenges

The main challenges facing smart grids – ie, doing more with less and improving efficiency, reliability, security and environmental sustainability – will depend on a combination of sensor, communication, information and control technologies to make the whole grid smart, from the entire energy production cycle through to delivery and utilisation.

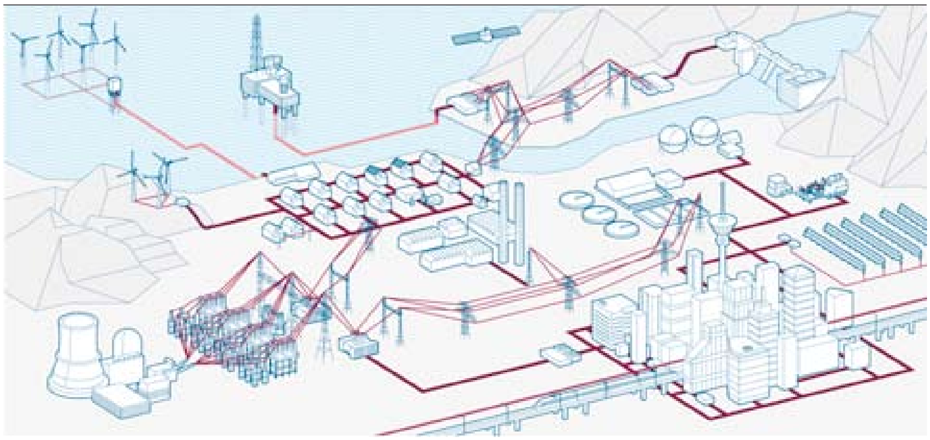
The most urgent technical challenges include:
- The economic buildup of grid capacity while minimising, as much as possible, its environmental impact.
- Increasing grid asset utilisation with power flow control and management.
- Managing and controlling power flow to reduce power loss and peak demand on both the transmission and distribution systems.
- Connecting renewable energy resources from local and remote locations to the grid and managing intermittent generations.
- Integrating and optimising energy storage to reduce capacity demand on grids.
- Integrating mobile loads (for example plug-in electrical vehicles) to reduce stress on the grid and to use them as resources.
- Reducing the risk of blackouts; and when one has occurred, detecting and isolating any system disturbances and the quick restoration of service.
- Managing consumer response to reduce stress on the grid and optimise asset utilisation.

Smart grid technology components

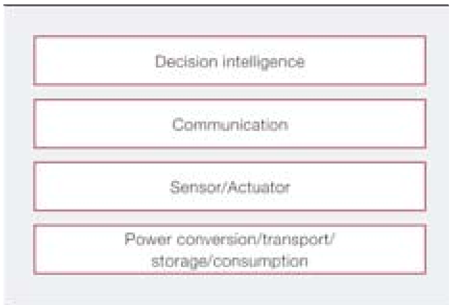
A smart grid consists of technologies, divided into four categories, that work together to provide smart grid functionalities. The bottom or physical layer is analogous to the muscles in a human body and it is where energy is converted, transmitted, stored and consumed. The sensor and actuator layer corresponds to the sensory and motor nerves that perceive the environment and control the muscles. The communication layer corresponds to the nerves that transmit

According to an International Energy Agency (IEA) forcast, the worldwide demand for electrical energy is growing twice as fast as the demand for primary energy.

5 Smart grid covers the entire generation, delivery and utilisation cycle.



6 Smart grid technology categories.



7 Application examples controlled from within the decision intelligence layer.

- Microgrid control and scheduling
- Intrusion detection and countermeasures
- Equipment monitoring and diagnostic evaluation
- Wide-area monitoring, protection and control
- Online system event identification and alarming
- Power oscillation monitoring and damping
- Voltage and var optimization
- Voltage collapse vulnerability detection
- Intelligent load balancing and feeder reconfiguration
- The control of a self-setting and adaptive relay
- End-user energy management
- Dynamic power compensation using energy storage and voltage-source inverters

the perception and motor signals. And the decision-intelligence layer corresponds to the human brain.

The decision intelligence layer is made up of all the computer programs that run in a relay, an intelligent electronic device (IED), a substation automation system, a control centre or enterprise back office. These programs process the information from the sensors or the communication and IT systems, and produce either the control directives or information to support business process decisions. These control directives, when executed by actuators, effect changes in the physical layer to modify the output from power plants and the flows on the grid.

The importance of decision intelligence and the actuator system in smart grids cannot be overstated; without controllable grid components to change the state of the power grid to a more efficient and reliable one, all data collected and communicated will be of very limited value. The more the output of power plants, the power flow on transmission lines and the power-consumption level of consumers are controlled, the more efficient and reliable grid operation can be. If, for example, the power flow control capability offered by flexible AC transmission system (FACTS) technology was not available, an independent system operator (ISO) would not be able to relieve transmission congestions without resorting to less economical dispatch plans. Or, without the ability to control devices such as transformer tap changers or automatic switched capacitor banks, the industry will not even contemplate the development of voltage and var optimisation control to reduce power loss.

For the decision intelligence layer to work, data from the devices connected to the grid need to be transmitted to the controllers – most likely located in the utility control centre – where it is processed before being communicated back to the devices in the form of control directives. All of this is accomplished by the communication and IT layer, which reliably and securely transmits information to where it is needed on the grid.

However, device-to-device (for example, controller-to-controller or IED-to-IED) communication is also common as some real-time functionality can only be achieved through inter-device communications. Interoperability and security is essential to assure ubiquitous communication between systems of different media and topologies and to support plug-and-play for devices that can be automatically configured when they are connected to the grid.

Smart grid solutions

Smart grids will be built with existing and emerging technologies. ABB has been at the forefront of smart grid technology development long before the term was even coined, and the following examples support this claim.

Wide area monitoring system (WAMS)

ABB's WAMS collects information about grid conditions in real time at strategic locations. Accurate time stamps are provided by GPS satellite. It performs enhanced network analysis, incorporating phasor data to detect any instability. WAMS technology was recognised by the Massachusetts Institute of Technology (MIT) in 2003 as one of the 10 technologies that can change the world.

Supervisory control and data acquisition systems (SCADA)

SCADA systems monitor and supervise thousands of measuring points in remote terminals on national and regional grids. They perform network modeling, simulate power operation, pinpoint faults, pre-empt outages and participate in energy trading markets. With more than 5 000 installations worldwide, ABB has more than any other supplier. The largest system in the world, in Karnataka, India, was delivered by ABB and has 830 substations that supply electrical power to 16 million people. This system can increase operation efficiency by 50% and reduce "customer minutes lost" by 70%.

FACTS that improve power transfer

FACTS devices compensate the line inductance for maximum power transfer (series compensation) and provide power flow control capability. In some cases, power system transmission capacity can even be doubled. They also mitigate disturbances and stabilise the grid (through dynamic shunt compensation). The world's largest static var compensator (SVC), with an operating range of +575MVAr (capacitive) to -145MVAr (inductive) at 500kV is located at Allegheny Power in the US and was delivered by ABB. In total, the company has installed more than 700 systems, or more than 50% of all global installations.

High-voltage DC systems (HVDC)

HVDC systems convert AC from power generation to DC for transmission before reconverting back to AC for consumer use. Grids running at different frequencies (50 or 60Hz) can therefore be coupled, while instabilities on one part of the grid can be isolated and contained. HVDC is ideal for transporting power from challenging locations (eg sub-sea) and over long distances with low losses; for example, by installing an ultra high-voltage direct current (UHVDC) connection, as is the case with the 2 000km link between Xiangjiaba and Shanghai in China, it is envisioned that transmission losses will be reduced by more than 30%. One of the world's longest and most powerful transmission systems, supplied by ABB, transports 6 400MW and operates at ±800kV.

HVDC also incurs lower infrastructure costs (due to fewer and smaller pylons and fewer lines) and this offsets the higher investment needed in converter stations. With more than 50 years of experience in HVDC technology, ABB is widely recognised as the market and technology leader in this area.

Fault detection and system restoration

A substation automation system is a key component of ABB's smart grid portfolio. It performs data acquisition, remote communication, supervision control, protection and fault evaluation. ABB's substation automation systems are compliant with the IEC 61850 communication standard to assure interoperability with similar compliant products. More than 700 such systems have been sold by ABB to date, with one of the world's largest substation automation systems being situated in Moscow.

Process control in power generation

The optimisation of auxiliary systems in power plants offers significant savings when one considers that up to 8% of a plant's production may be consumed by these systems. Additional savings can be realised by improving both the combustion system process and start-up times for boilers. Savings in both thermal and electrical energy can be achieved using existing ABB technologies.

Driving toward industrial efficiency

The optimisation of motor-driven systems offers the single largest energy-saving potential in industry. The installation of drive systems alone could save around 3% of energy, equivalent to the output from more than 200 fossil power plants (each producing 500MW). The global installed base of ABB drives provides an annual saving of 170 million tons of CO_2, which corresponds to 20% of total emissions in Germany. Process control is another effective and immediate way for industry to achieve energy savings of approximately 30% using existing ABB technologies.

Building control for optimal performance

According to the World Business Council for Sustainable Development (WBCSD), automation systems installed in buildings can reduce energy consumption by up to 60%, while global consumption could fall by as much a 10%. ABB building control systems allow the individual adjustment of rooms and appliances to ensure energy consumption is at its most efficient. For example, using ABB's i-bus/KNX technology, which is used in hotels, airports, shopping centres and houses around the world, energy consumption was reduced by 30% in several large buildings in Singapore.

Solar and hydropower

ABB supplies power plant control for hydro, wind and solar plants, as well as tailor-made long-distance connections to integrate green energy sources to the grid. Such an automation system and associated electrical equipment has already been delivered to Europe's first large-scale 100MW solar plant in Spain, at Andasol. In Algeria, the complete plant control for the world's first integrated solar combined cycle plant (175MW) has also been supplied by ABB, while a turnkey 1MW solar concentration plant, with a performance ratio of 80%, was constructed in Spain in record time. To date, ABB has connected 230GW of renewable energy to the grid.

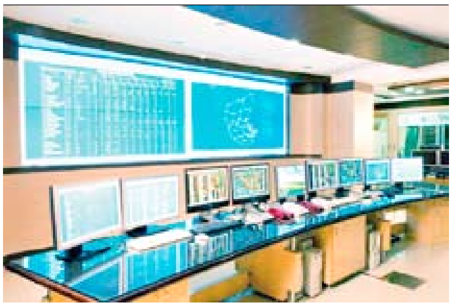
Offshore wind parks

ABB is the world's largest supplier of electrical equipment and services to the wind energy industry. It supplies complete electrical systems for wind generation as well as sub-sea connections to onshore grids. HVDC Light®, with its oil-free cables and compact converter stations, will connect the Borkum offshore wind park, one of the world's largest with a capacity of up to 400MW and located 125km out to sea, to the German national grid.

Energy storage to bridge outage periods

The total electrical power input and output on an interconnected grid must be closely balanced at all times. Any imbalance will

8 The control room at Karnataka Power.



9 An impression of an SVC Light® with Energy Storage installation.

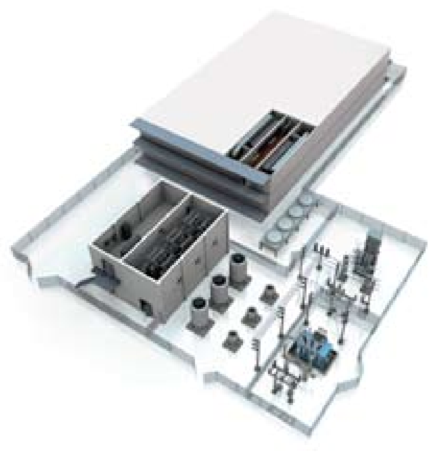


ABB has been at the forefront of smart grid technology development long before the term was ever coined.

Electricity is the most versatile and widely used form of energy in the world.

Smart grid technology is not a single silver bullet but rather a collection of existing and emerging technologies working together.

cause the system frequency to deviate from the normal value of 50 or 60Hz. Balancing power is a major issue for utilities and is especially critical as large amounts of intermittent wind and solar energy are added to the supply mix. Bulk storage of electrical energy helps to compensate for any imbalance in the system and reduces the need for expensive spinning reserve capacities. Battery systems with DC to AC converters are one way of coping with the problem. The world's largest battery energy storage system[2] (BESS) is located in Fairbanks, Alaska, and was installed by ABB. This installation can supply 26MW of power for 15 minutes, giving the utility enough time to bring back-up generation on line in the event of an outage.

Integrating storage with FACTS

FACTS devices regulate power flow or voltage in a grid to maximise capacity by regulating the line's reactance or by injecting reactive power. By combining a battery storage system with FACTS (to create SVC Light® with Energy Storage[3]), active power can be injected or extracted as needed and quickly. In addition, it provides power balancing, peak power support, and voltage and power quality control. This solution will be in operation in 2010. Future systems will operate in the MW range.

Building the grid of the 21st century

Smart grid technology is not a single silver bullet but rather a collection of existing and emerging technologies working together. When properly implemented, these technologies will increase efficiency in production, transport and consumption; improve reliability and economic operation; integrate renewable power into the grid, and increase economic efficiency through electricity markets and consumer participation. A century of technological leadership has equipped ABB with a broad portfolio of products and systems that will be called upon to build and operate the smart grids of the 21st century.

Footnotes

2 BESS comprises a massive nickel-cadmium battery, power conversion modules, metering, protection and control devices, and service equipment. In operation, BESS produces power for several minutes to cover the time between a system disturbance and when the utility is able to bring backup generation online.

3 For more information, refer to "Storage for stability: The next FACTS generation" on page 24 of issue 2/2010 of *ABB Review*.

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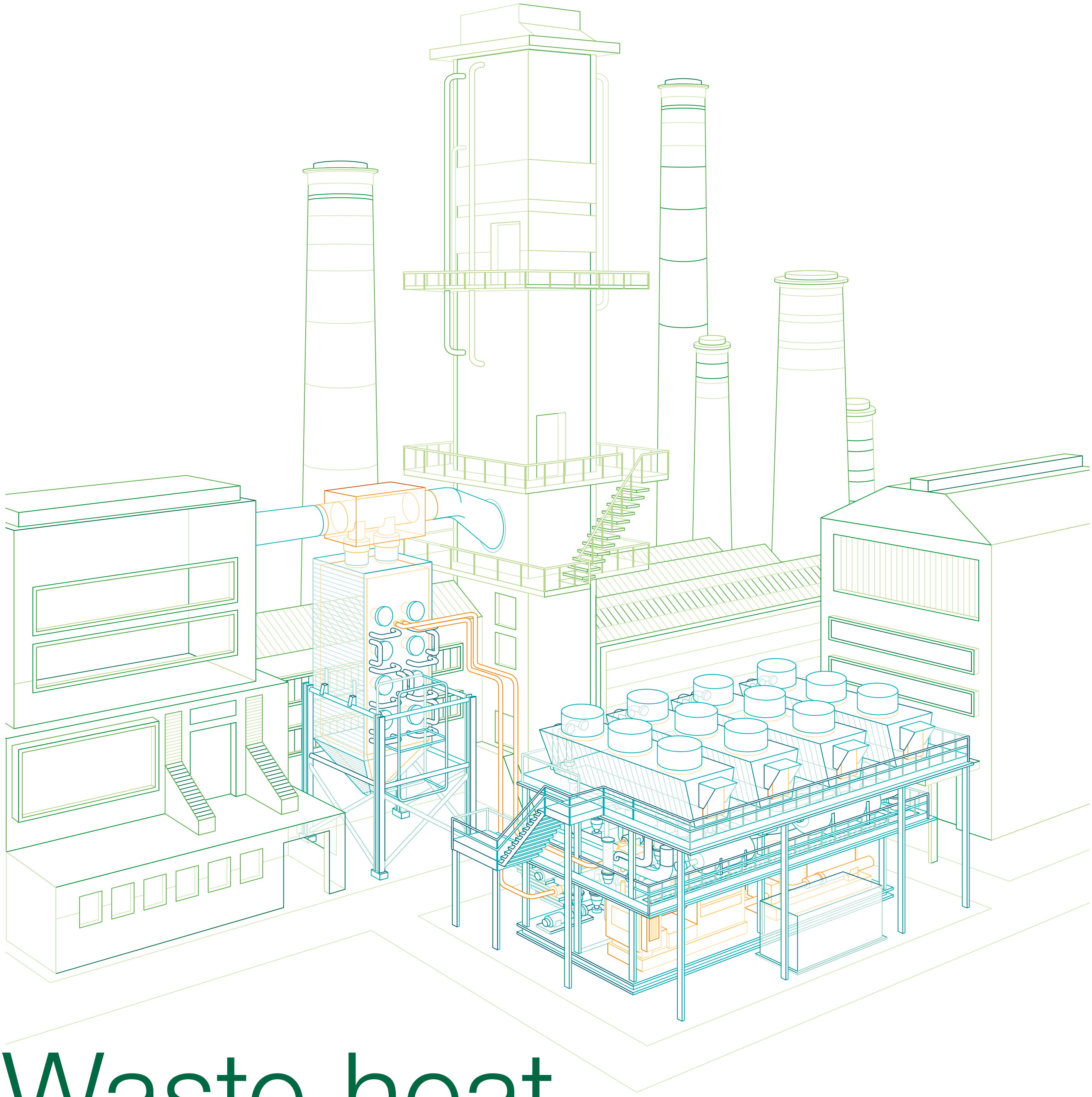
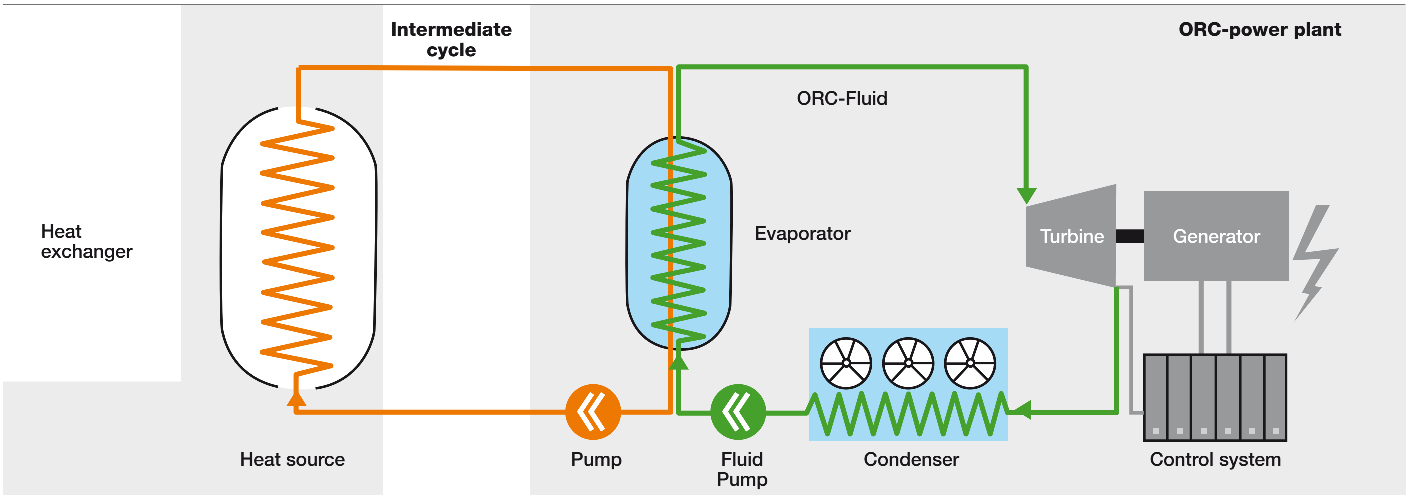


Waste heat becomes electricity

ABB Switzerland is about to launch a system for industrial companies to generate electrical energy from waste heat as low as 150 °C – a milestone in efficiency and environmental protection.

It is too bad that industrial plants discharge waste heat into the environment day after day and do not use it productively – thereby losing millions of dollars every year. This is especially regretful at a time when energy prices are on the rise and when every business is called upon to cut CO_2 emissions as much as possible.

Its modular design allows ABB's heat recovery system to be applied in virtually all industrial processes. Organic-Rankine-Cycle technology makes it suitable for applications at temperatures as low as 150°C.



ABB's heat recovery system essentially consists of three modules: an intermediate cycle with one heat exchanger per heat source, a power plant plus standard components for power generation (turbine, generator and control system) and a cooling unit (condenser).

Systems have been successfully generating energy from waste heat at high temperatures for some time now. Few systems, however, have proven effective at recovering waste heat at lower temperatures, between 150 and 400°C, especially for the purpose of generating electricity.

About four years ago, this seemingly unavoidable waste of energy led the staff of ABB in Switzerland to examine the problem more closely. At ABB's local Business Unit Minerals in Baden-Dättwil, Switzerland, the question arose: Can we support our industrial customers in utilising their waste heat and, if so, how? In the quest for improved energy efficiency, and as part of ABB's worldwide commitment to sustainability and protection of the environment, a heat recovery system has been developed and is ready for launching.

"Our small power plant enables industrial plants to utilise waste heat effectively by generating electricity anywhere in the range of a few hundred kilowatts to double-digit megawatts," explains Thomas Börrnert, head of the heat recovery unit at ABB's local Business Unit Minerals in Switzerland. "It turns previously unrecovered heat into electrical energy – in a way that's efficient, economic and free of CO_2."

ABB's heat recovery system can be applied in almost all industrial processes – indeed, anywhere there is waste heat. The system's modular design enables its use in temperatures ranging from 150 to 400°C. ABB's Börrnert identifies potential customers among cement producers, in the steel, aluminum, paper, chemical, incineration industries, and possibly in the oil and gas industries – in other words, potential for all customers of the local Business Unit Minerals and virtually all industry customers of ABB.

Competitive edge of the cost-saving kind

Börrnert sees enormous user benefits in ABB's latest development: "Think of the image boost that comes with having a heat recovery system. The creation of CO_2-free energy is definitely bound to create a competitive edge. More than anything else, though, the installation of the ABB system will pay for itself over a short period of time. As far as reducing operational costs and boosting energy efficiency goes, nothing beats having your own power source. Producing their own energy makes our customers less dependent on electricity prices, which will keep going up anyway. Plus," adds Börrnert, "our system starts to pay off for our customers in only a few years, due to our use of standard components, which serves to keep investment costs low."

All in all, the potential of ABB's heat recovery system to raise the profitability of industrial processes is quite obvious. Add to that low maintenance costs, which further guarantee high ROIs in the long run.

From its initial concept phase three years ago to final development last year, ABB's system is now poised to take on the market. Plans call for a launch in Switzerland, Germany and Italy as it is sent on its task of cutting CO_2 emissions of industrial companies and ensure lower production costs around the globe.

Marketing started

Feasibility studies among ABB customers have shown success, and the process has reached the point of contacting and informing potential customers – and even negotiating initial sales contracts.

How long will customers have to wait for the new system once they've ordered it? "From the point of initial contact, and depending on the type of system ordered, clients may expect one and a half years for their systems to arrive," says Börrnert.

Local Business Unit Minerals in Baden-Dättwil

LBU Minerals boasts a comprehensive portfolio of products and services, mostly geared to the cement, minerals processing and aluminum industries, as well as to ore smelting processing and newspaper printing. It covers the entire range of electrical and electronic equipment, ranging from drives and process control all the way to management information and optimisation systems for integrated facilities.

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