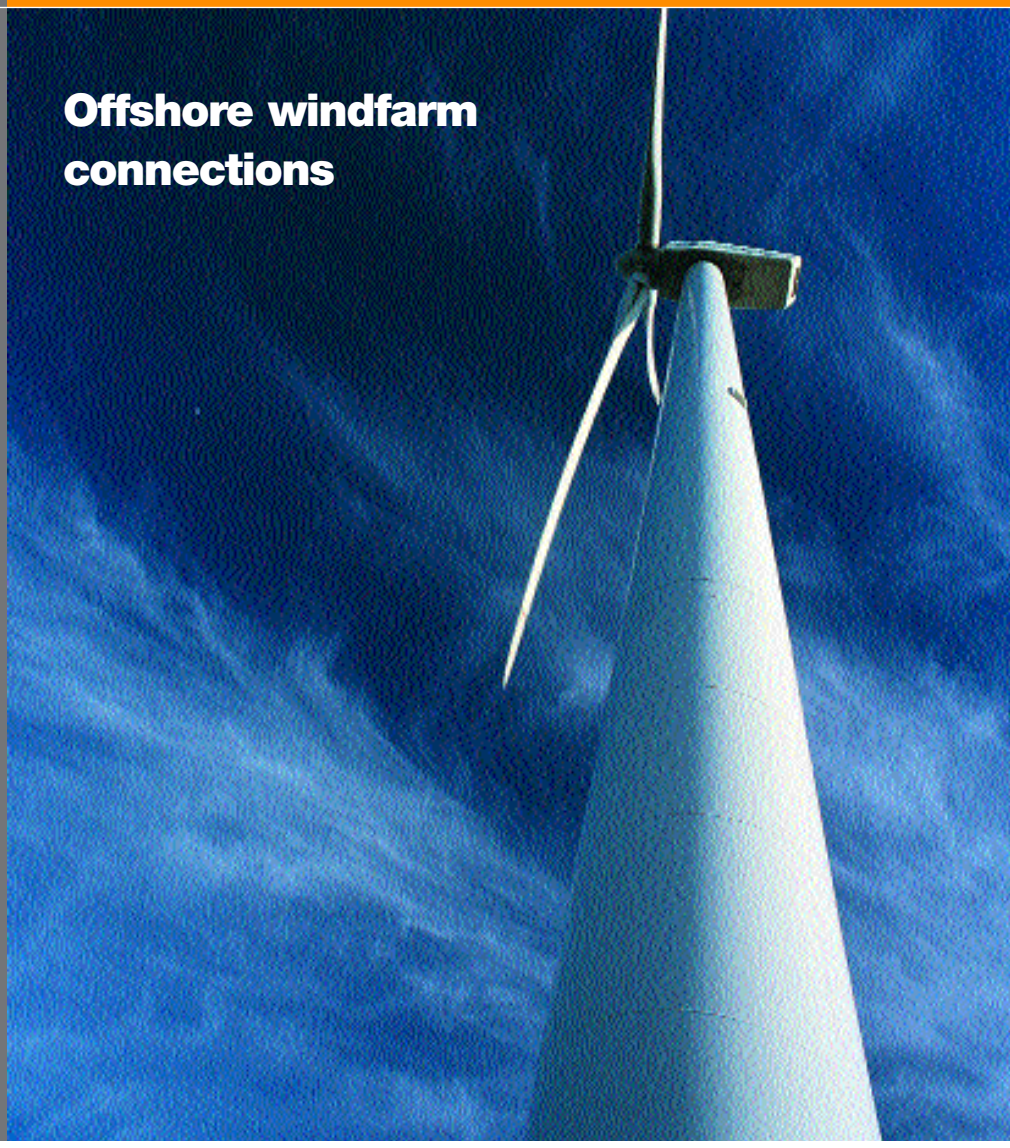
FWD

Winter 2003/4

FAST FORWARD WITH **ABB POWER TECHNOLOGIES**



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Be aware of the FACTS

Trevor Gregory
ABB UK Managing Director

- Plans to minimise the risk of winter blackouts and ensure additional capacity can rapidly be brought on stream are being drawn up by the government, Ofgem and the National Grid in the wake of recent US and European power failures.
- Faults will always occur in power systems. But, if handled correctly, they should just result in localised power cuts of relatively short duration. Most blackouts are caused by errors and equipment failures, rather than lack of generation capacity. So the main focus of attention must surely be on finding fast and effective ways of increasing the stability of electrical grids.
- In a blackout the complete system collapses affecting all electricity consumers in the area. The overload of the transmission system is often triggered by a single and sometimes minor initial event. The trick is to avoid the 'domino effect' by rapidly disconnecting the faulty part and having the muscles, speed and intelligence within the system to stabilise the remaining healthy part.
- FACTS (Flexible AC Transmission Systems) are technologies that can do just that. They enhance the reliability and flexibility of power transmission systems. And, equally important, they enable better utilisation of existing infrastructure.
- FACTS technologies can be divided into two main categories – dynamic shunt compensation to maintain voltage stability and series compensation to increase transmission capacity and improve the reliability of the power system.
- ABB has helped a number of electrical utilities around the world utilise FACTS technologies to improve stability and increase transmission capacity without the need to build new overhead lines.
- A recent major order is for the Pacific Gas & Electric (PG&E) electrical transmission network in San Francisco, California. The FACTS installation will stabilise the power system during peak loading and network contingencies, substantially lowering the risk of voltage collapses. This contract is the second static var compensation (SVC) order from PG&E.
- To learn more about how ABB FACTS technologies and policies can help prevent blackouts visit the new power outages portal site on our web site (www.abb.com).

Energisation of National Grid's new City Road North 400kV indoor substation is helping EDF Energy to reinforce the electricity distribution system serving the London area. Located in an urban regeneration area at the City Road canal basin in Islington, North London, the architect-designed building houses ABB's compact gas-insulated switchgear.

City Road North energisation reinforces London power grid

Demand for electricity in London is growing so it was hard hats and smiles all round from the ABB and National Grid team at the new City Road North substation when full energisation took place in early August.

CLOSE COOPERATION

The three-year design and build project highlights how industry can work in harmony with the local community and clearly demonstrates to the regulator and future clients that National Grid can meet the tightest schedules and deliver a first class service with minimum disruption.

Tom Smith, ABB project manager explains. "For National Grid and ABB this was one of the most onerous projects undertaken from an environmental and community impact point of view.

"City Road North is located in a busy inner-city site in Islington, surrounded by both domestic housing and commercial and industrial premises. The site also backs on to the City Road Basin on the Regent's Canal. This is being regenerated to create a vibrant location for business, residential and leisure use.

"In addition to dealing with contaminated ground and ensuring no land or water pollution when working on the site, a great deal of logistical planning was needed to move heavy plant and materials in and out and keep the canal access open while carrying out major works.

"At peak workload we had 50 people on site as well as having to co-ordinate other contractors," continues Smith. "Arranging for the 200-tonne transformer to be shipped to Tilbury Docks and then transported by road to Islington, for example, involved liasing with no fewer than 24 different agencies."

ABB worked in close partnership with National Grid to meet its strict environmental criteria, creating minimal noise and dust nuisance, and complying with the company's community relations contractual requirements to minimise disruption to local residents and businesses.

National Grid ensured that the local community was kept fully informed at all stages of the project via newsletters and letter drops. One-to-one meetings were held for those directly affected, particularly

on the tow path route. And a 24-hour free phone help line was set up to deal with enquiries and concerns. National Grid also supported the annual Angel Canal Festival.

ARCHITECT-DESIGNED

The new City Road North substation has been constructed adjacent to the existing City Road substation. Specifying ABB's compact gas-insulated switchgear (GIS) technology enabled the 400kV substation to be housed inside a new brick building designed by Markwick Architects to complement the style of existing buildings in the area. This is in line with Islington Council's redevelopment of the City Road Basin, which aims to improve access and recreational opportunities and enhance the local urban environment.

TURNKEY PROJECT

As turnkey project manager, ABB was responsible for all engineering design and civil works at City Road North as well as the complete installation and commissioning of the substation switchgear and ancillary equipment.

ABB supplied four GIS switchbays and associated equipment, together with a 240MVA 400/132kV transformer and substation protection and control systems. The project also included the demolition of a four-storey office block. And, diversion of an existing 400kV cable linking the City Road substation to the West Ham substation six miles away in East London into the new substation to make the West Ham/City Road North and City Road North/City Road circuits.

Power boost for West Coast Main Line

Work at Rugeley Power Station includes responsibilities for protecting wildlife and providing access to the onsite nature reserve.

An £8 million contract to upgrade an existing substation at Rugeley Power Station in Staffordshire has been won by ABB. The work is part of Network Rail's West Coast Main Line power supply reinforcement programme. The contract places particular emphasis on safeguarding flora and fauna and protecting badgers that live on the site.

The contract includes providing two new 400/25kV connections and will enable Network Rail to upgrade its local trackside power supplies to the 50kV system required for high-speed rail services.

The work involves installing two new ABB 400/26.25-0-26.25kV 40+40MVA SGTs (supergrid transformers) at the 400kV National Grid substation, constructing a 25kV compound, supplying switchgear and providing 25kV XLPE cables and associated fibre optic pilots between the two sites.

ADVANTAGES OF 50kV SYSTEM

The 50kV system is widely used in mainland Europe for high-speed services. Power is distributed down the trackside as a centre-tapped to earth 50kV system with trackside auto transformers feeding conventional 25kV supply to the locomotives via catenary and pantograph. Compared with the conventional 25kV system involving booster transformers, this arrangement provides economies in the number of feeder stations required to supply traction loads and reduced interference on communications circuits.

ABB has won all the 400kV power upgrade orders placed to date for the northbound section of this line.

NATURE CENTRE

Rugeley Power Station takes its commitment to safeguarding its physical environment, wildlife and on-site nature reserve very seriously. It works closely with the local community, especially schools, welcoming visits and providing a specially-created Environment Centre. Here, people can learn about pollution control, environmental management and the natural life that thrives on the site. It also plays host to an angling club that fishes the lake on the site.

ABB carried out a full risk assessment study to identify any potential hazards and is implementing measures to minimise the possibility of damage from waste or oil spillages. The company has taken the advice of a badger consultant so it can avoid damaging the animals' habitat and ensure their safety while the work continues.

ABB and Rugeley Power Limited are accredited to the ISO 14001 Environmental Management Standard.

1 Sarah Hadfield, ABB site project manager at Rugeley Power Station, monitors plans for site work.

In visible control

A substantial contract to upgrade the operator control system at the Medway Power Station has been completed by ABB, working with the site engineers. The new operator display system provides real state-of-the-art management and control facilities and is the first major upgrade to the control system since the plant was opened in 1997.

The dual fuel combined cycle 688MW power station has one steam and two gas turbines. Its owner, Medway Power, is wholly owned by Scottish and Southern Energy plc.

The power plant automation architecture provides all the technical capabilities required and the display system provides a powerful and effective interface. It offers a great many ways of looking at the process: hierarchically structured process displays, data on the health of the automation processes and much more information. In addition, historical data gathered from the information management system is available to operators in the form of trend displays.

The tight integration of the operator display systems gives direct access to all information available anywhere in the control system. Operators can easily investigate every function quickly and in great detail thus reducing the time to track any problems in the plant.

The new display system was ordered, configured and thoroughly tested in just a few weeks. It was installed in just five days during the plant's two-week summer shutdown.

As part of the contract Medway Power also ordered a new 'Composer' engineering tool from ABB. This software permits changes to be made to control strategy at site level even more quickly than before and provides highly efficient handling of document changes.

A new light on blackouts

If we are to believe the mass media the recent blackouts and power outages are the shape of things to come. This doom and gloom scenario is constantly raised with very little constructive thought or interest in possible solutions.

ABB has been making its global experience directly available to customers on the web and, most recently, through a special dialogue event for the technical press.

ABB believes that it has a unique perspective, some very practical technical solutions and a wealth of experience to offer generators, transmission companies and industry.

The Group has launched a global programme to make sure that customers throughout the world know what it can offer. The emphasis is on reliability, effectiveness and economy.

A new web portal *www.abb.com/poweroutages* has been launched and a special online issue of ABB Review published. Both these provide detailed information on possible solutions such as ABB's own HVDC Light technology, as well as mainstream HVDC and FACTS (Flexible AC Transmission Systems).

In the UK the marketing communications team invited a group of editors from leading technical journals to participate in an 'Editors' Roundtable'.

The discussion was moderated by former Ofgem Technical Director, Brian Wharmby. ABB participants included Trevor Gregory, UK Managing Director; Peter Jones, Network Solutions Manager; and Group technology expert, Carl-Axel Roseen.

Hospital's £300,000 power upgrade

A major upgrade of power systems at Nottingham City Hospital (NCH) has opened the way for planned future development on a previously unused area of the site. The electrical equipment has been supplied by ABB as part of a contract worth over £300,000.

ABB's work has involved the complete electrical engineering installation of a new distribution substation within a purpose built facility. The substation is connected to the hospital's existing HV ring main system. A 1MVA 11kV/433V transformer has been installed and space is available for a second transformer as demand increases.

A 1MVA standby generator is also in place and this, together with the transformer, feeds into a purpose made low voltage switchboard complete with an ASCO fast transition switching device to provide seamless switching between mains and standby supplies. The ASCO Closed Transition Transfer and Bypass Isolation switch allows planned maintenance and periodic generator testing to be carried out without interrupting the hospital's power supply. Other services provided include fire alarm, small power and lighting.

According to Mick Wyer, engineer with the NCH Property Services Department, "ABB has shared the benefit of its wide experience in the world of electrical services. This has added value to the project and helped ensure that this part of the hospital site is ready for the expansion of services to the community which will take place over the next few years."

INTERNATIONAL NEWS

US

Bridging the east/west divide

A new ABB HVDC (high voltage direct current) transmission system links the United States' eastern and western power grids. The $50 million 'Rapid City Tie', named after Rapid City, South Dakota, carries 200MW of power and was completed by ABB in less than 19 months. HVDC technology converts alternating current from one grid into direct current for transmission and then re-converts it to AC for the other grid.

Lighting from Las to Los

A 25 percent boost in the capacity of the Las Vegas-Los Angeles transmission corridor will be on line in time for the summer of 2004 thanks to innovative ABB technology. While it will take years to create new generating capacity, ABB's Flexible AC Transmission Systems (FACTS) can be implemented quickly. Separately, ABB has won a major contract to supply FACTS technology for the transmission network serving the San Francisco area.

CHINA

Mass transit gears up

ABB has been chosen to supply medium voltage switchgear for the new urban mass transit systems being built in the Chinese cities of Shanghai, Guangzhou, Beijing, Shenzhen and Tianjin. The most recent contract, worth $18 million, is the largest order of its kind received by ABB in China.

MIDDLE EAST

Power share will benefit developing economies

Four countries of the ancient Levant – Egypt, Jordan, Syria and Turkey – are using modern ABB technologies to help them interconnect their national power grids. A range of equipment including transformers, substations and communications systems will be supplied to the national utilities who are working together to bring more power to rural areas, in particular.

MALAYSIA

A $21 million contract to rehabilitate and upgrade five 275/132kV substations in Malaysia has been awarded to ABB. The order is part of a project by the Malaysian utility, TNB, to upgrade the electrical infrastructure around Kuala Lumpur and the north of the country.

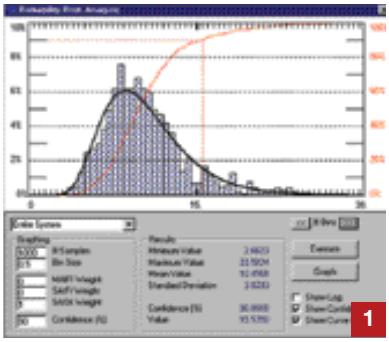
NAMIBIA

Ensuring the uptime of an 890km power line

A reliable power supply is absolutely crucial to Namibia's two main industries – mining and tourism. The availability and stability of a new 890km 400kV transmission line from neighbouring South Africa has been safeguarded thanks to the addition of an ABB Static Var Compensator (SVC). The SVC is designed to provide 99.7 percent availability on a line which would otherwise suffer from frequent failures caused by extremely high and sustained over-voltage.

ABB has developed a comprehensive range of windpower infrastructure solutions that enable power generated offshore to be brought to the mainland efficiently and reliably and connected into the local or national transmission grid.

Complete connection solutions from offshore windfarm to the national transmission grid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ABB's flexible windfarm connection service includes complete turnkey packages from feasibility studies through to installation, commissioning and ongoing maintenance as well as the supply of individual components.

Financial modelling

ABB's specialist software can evaluate the financial and operational risks involved in undertaking an offshore windfarm project, including a full Monte Carlo analysis **[1]**. The result is a system optimised to provide the most cost-effective combination of engineering, financial and regulatory requirements.

Transformers

ABB transformers convert the 690V produced at the wind-turbine to the 33kV required for interconnection via the local ringmain and/or an offshore substation. A dry type resin transformer **[2]** designed specifically for windpower applications can be installed in the nacelle or tower, conventional oil-filled transformers are also available.

ABB transformers are also found at all the key stages in the transmission link, from intermediary offshore and onshore 33kV/132kV substations to connection to the local or national transmission grid at 275 or 400kV.

Switchgear

ABB GIS and AIS switchgear meets all windpower switching needs from MV to EHV. Where space is at a premium, such as in an offshore substation, compact GIS switchgear **[3]** is the ideal answer.

Submarine power and control cables

ABB has a long history as a global manufacturer and installer of submarine power cables for both AC and DC. Extruded XLPE cable provides the ideal environmentally friendly solution for applications up to 170kV and 300MVA such as the loop connections between a string of windturbines and the offshore substation and the onshore connection. Integrated fibre optics can also provide the communications links for the control systems.

As well as supplying the cables, ABB offers a skilled and experienced installation team which operates its own vessel and can bury the cables under the seabed either by ploughing in or water jetting **[4]** as well as providing mechanical protection where needed. ABB can also undertake subsea surveys.

Offshore substations

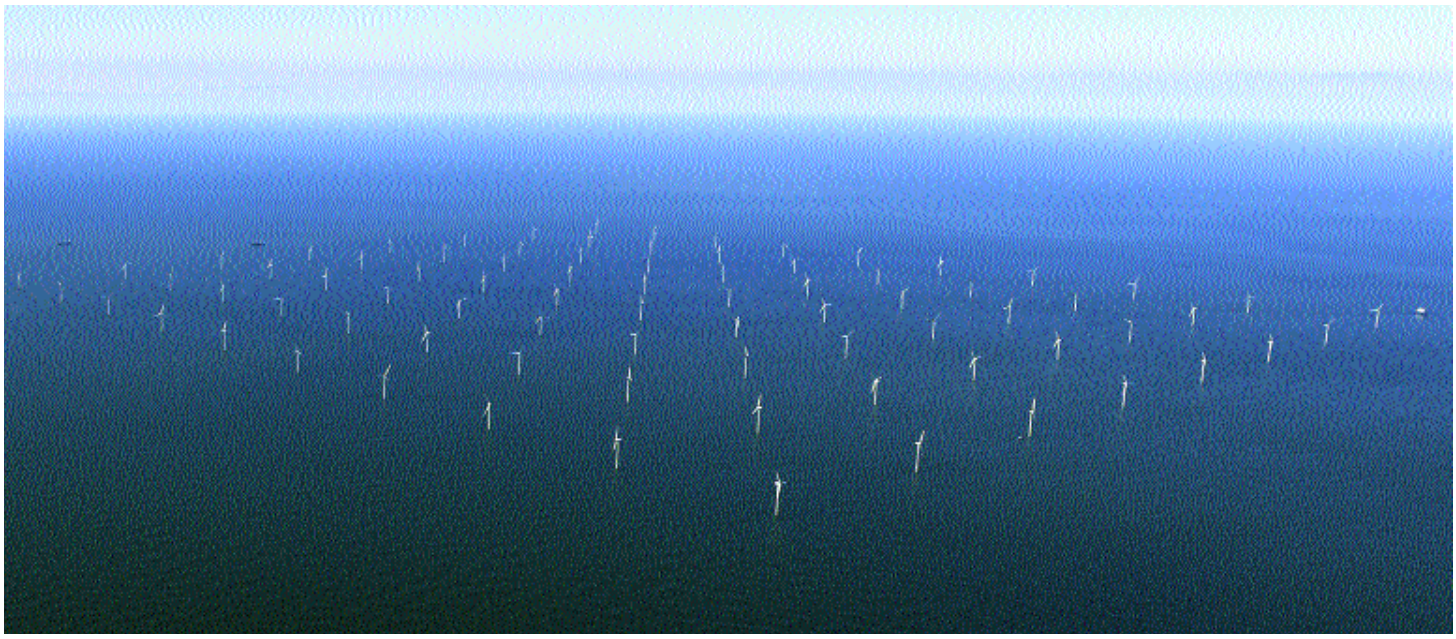
ABB's complete service for offshore substations includes the design, layout and supply of all 33kV and 132kV switchgear and transformers together with standby power and deluge systems for fire protection.

Onshore substations

ABB is a world leader in the design, installation and commissioning of GIS and AIS substations **[5]** up to 400kV including the negotiation of wayleaves and easements and all civil engineering works.

SCADA, Industrial IT

SCADA systems utilising ABB's Industrial IT philosophy provide the means to monitor and control all aspects of the windfarm operation, such as adjustment of the turbine blade pitch and power output as well as condition monitoring of bearings and maintaining records of switchgear operations.



SCADA also plays a vital role in meeting the protection requirements of electrical networks.

SVC Systems

The introduction of national grid codes demand that new developments such as windfarms can demonstrate their ability to 'ride through' any reflected fault from the grid. ABB can undertake reliability studies to assess the potential risk and then design and manufacture the appropriate SVC (Static Var Compensator) solution to maintain grid stability.

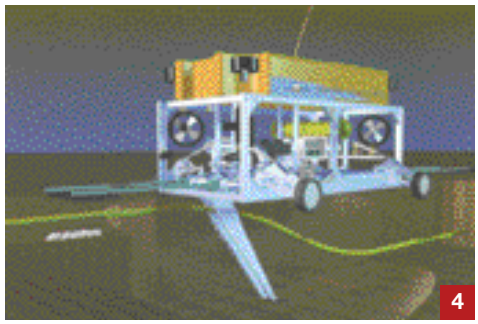
HVDC Light

Connecting offshore windfarms to conventional AC grids has always represented a challenge, since AC systems can be destabilised by the variation in frequency as the wind speed changes. HVDC Light, ABB's high-voltage direct current transmission system, eliminates this problem by converting the variable frequency power into DC power **[6]**.

HVDC Light can transmit power economically over long distances, with transmission losses up to 50% lower than in AC systems, so it is ideal for offshore windpower schemes.

Network Connections

ABB offers a turnkey solution for the connection of windfarm sites to the distribution or transmission network operator's assets. By taking advantage of new legislation governing competition in connections, ABB can offer the design and construction of the contestable element together with the negotiations for, and the project management of, the non-contestable element of such connections.



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As part of its mission to promote choice and value for customers, Ofgem recently carried out a review of competition within the connections industry.

Getting Connected

Ofgem's findings show that a total of 414,916 electricity connections were undertaken in the UK during the review period June 2002 to May 2003. These comprised 252,000 low voltage, 719 high voltage, 18 extra high voltage, 179 distributed generation and 162,000 unmetered connections.

Currently just four percent of low voltage and less than one percent of high voltage connections are undertaken by Independent Connection Providers (ICPs). This is despite consumers (house builders, service sectors, local authorities and universities) highlighting competitive pricing and enhanced customer service as two advantages of using an ICP.

Following the review, the Regulator has set up an Electricity Connections Steering Group to promote competition in connections and is also looking into service standards.

THE RIGHT CONNECTIONS

ABB's new connection activities extend from the regulated provision of all service alterations for REC customers to the turnkey management of multi-million pound competitive new connections for the commercial and industrial market. Since the beginning of 2000 our engineers have completed over 10,000 service alterations and independently managed the connection of over 800MW of new load from low voltage to 132kV.

According to Karl Young, Connections Business Manager at ABB: "Procuring and delivering utility connections is a major concern for consumers both in terms of cost and project delivery. ABB's success in this area is attributable to the fact that we take the problem away. We manage the interface with the host utility, reduce costs, improve cash flow, speed up the programme and reduce the overall project risk. Our successes at New Providence Wharf, Chelsea Bridge Wharf and Birmingham University are excellent examples of this."

NEW PROVIDENCE WHARF

The deciding factor in Ballymore Properties awarding ABB the contract to design and build the 11kV electrical distribution network for New Providence Wharf was ABB's capability to meet a very tight project schedule – 'power on' for the first two development phases in January 2003.

The 8.3 acre Providence Wharf site in London's Docklands will include 735 riverside apartments, a five star hotel, 500,000 sq ft of office space plus retail units, restaurants and leisure facilities all requiring some 12MVA of power.

The 11kV distribution network for the first two phases comprises a kilometre of underground cable which takes four incoming supplies from London Energy's switching station at Brunswick Wharf and distributes the power via a 12 panel primary board to the local distribution transformers.

CHELSEA BRIDGE WHARF

Berkeley Homes enjoyed 30 percent capital cost savings when it engaged ABB to provide the utility connection to its new residential and commercial development at Chelsea Bridge Wharf.

To meet the site's 6MVA supply requirement, 6km of 11kV power cabling were laid from a primary substation through central London to the development site. ABB undertook the planning, design and construction of the complete network including six substations.

UNIVERSITY OF BIRMINGHAM

The University of Birmingham's new primary electrical substation has boosted the campus' power capability by around 70 percent as well as ensuring reliability of supply. Designed and constructed by ABB it features ABB's innovative LTB Compact switchgear. This enabled a dual circuit 132/11kV substation to be condensed into around half the space required for a conventional design.

ABB also carried out the new HV connection to the Selly Oak substation – the UK's first 132kV contestable connection.

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1 New Providence Wharf in Docklands. ABB met a very tight project schedule for 'power on' of the 11kV distribution network serving the first two development phases.

2 Berkeley Homes benefited from cost savings and hassle free delivery when it chose ABB for the 11kV electrical distribution network for Chelsea Bridge Wharf.

Widely publicised power outages and the high costs of building new transmission lines is focusing attention on making existing and new infrastructure more efficient and ensuring a high quality reliable supply. Stephen Trotter, who was appointed recently as General Manager of ABB's Power Systems Projects Division, explains how Static Var Compensators can be used to extend power transfer limits and improve power flow through effective and rapid control of reactive power.

It's not the power IN that counts ...

Ideally a transmission system should carry power up to its thermal loading limits. This would result in maximum utilisation of transmission assets. However a power system is complex and subject to constraints such as voltage limits, stability limits and loop flows. In practice, this means that a 400kV line cannot usually be expected to transmit more than 450-500MW over any 'reasonable' distance unless very specific measures are taken to safely increase the power transfer capability.

FACTS (Flexible AC Transmission Systems) technologies are designed to remove such constraints and create possibilities to run the transmission system close to its thermal limit. They are particularly suitable for applications requiring rapid dynamic response, ability for frequent variation in output and smoothly adjustable output or fast implementation.

One of the most widely used and proven FACTS devices is the Static Var Compensator (SVC). Its fast Var (volt amp reaction) capability makes it highly suitable for steady state and dynamic voltage stabilisation, dynamic balancing of unsymmetrical loads and power oscillation damping.

WHY SVC?

The nature of AC power flow is such that transmission lines store energy in the form of electric and magnetic fields. This stored energy is reflected in flows of reactive power. In general, lightly loaded lines generate reactive power and heavily loaded lines consume reactive power. Reactive power produced or consumed by transmission lines impacts system operating voltage.

An SVC has the ability to support the voltage level in a specific area of the power system by automatically and instantaneously adjusting the reactive power output smoothly compared to the reference voltage level, thus maintaining voltage stability.

For rapid events such as when lightning hits a line section it is very important that the faulty section is disconnected and that the remaining healthy part of the power system has the ability to stay in service. An SVC has the ability to quickly detect and automatically adjust its output for maximum support of the voltage i.e. it provides transient stability.

HOW IT WORKS

An SVC comprises standard inductive and capacitive branches controlled by thyristor valves connected in shunt to the transmission network via a step-up transformer. Thyristor control gives the SVC the characteristic of a variable shunt device.

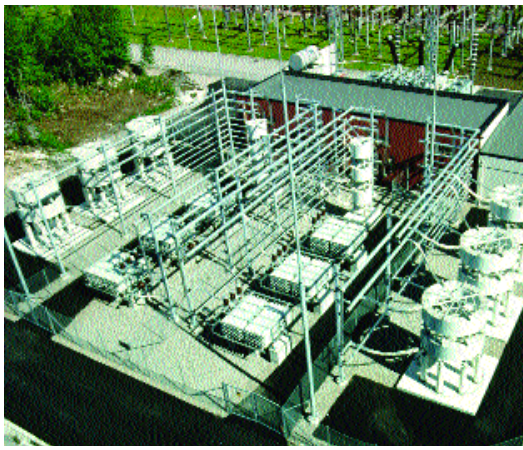
The SVC operates by measuring the actual voltage and automatically generating or consuming system reactive power through its capacitors and reactors, hence automatically providing voltage and transient stability.

In terms of its steady state performance, an SVC acts much like a synchronous condenser but with the advantage that it has no inertia, and contributes nothing to the network short circuit level. In comparison to switched capacitor banks, it can operate repeatedly and is not encumbered by the delays associated with mechanical switching. This enables the SVC to respond very rapidly to changing network conditions such as line or generator outage contingencies, or loss of major loads.

APPLICATIONS

Installing an SVC at one or more suitable points in the network can improve transmission capacity by 10-50 percent through increased transfer capability while maintaining a smooth voltage profile under different network conditions. The dynamic stability of the grid can also be improved and active power oscillations mitigated. A further benefit is that transmission losses are reduced in many cases.

The three principal installation points for SVCs are as follows. Close to major load centres such as large urban areas to mitigate the effect of disturbances in the grid on sensitive loads and to reduce the probability of loss of load due to voltage collapse. At critical buses for voltage control and to guarantee stable and efficient transfer of power during and immediately following network disturbances. And, finally, at infeeds to large industrial and traction loads for both fast voltage control (flicker) and phase unbalance control.



A SOLUTION FOR EVERY APPLICATION

ABB SVCs can be used for symmetrical three phase control or phase-by-phase control. The range includes:

- Thyristor controlled reactors
- Thyristor controlled reactors/fixed capacitors
- Thyristor switched capacitors
- Thyristor controlled reactors/Thyristor switched capacitors
- Relocatable versions

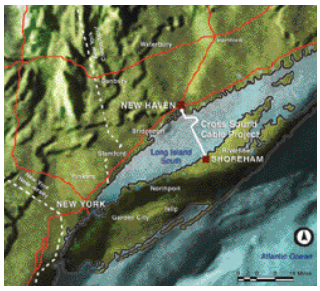
SVC power transmission benefits

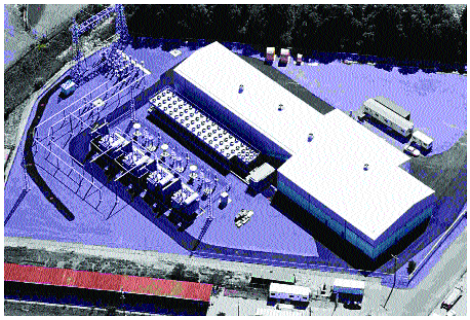
An ABB SVC can boost transmission capacity by 10-50 percent through:

- Stabilised voltages in weak systems
- Reduced transmission losses
- Increased transmission capacity
- Higher transient stability limit
- Increased damping of minor disturbances
- Greater voltage control and stability
- Power swing damping

After 14 months of negotiations, a $120 million underwater power line connecting two US states helped restore electricity to a region hard hit by two days of blackout.

THE BIG TURN ON





In August 2003 the 45km (28 mile) 330MW Cross Sound underwater cable, linking Long Island and Connecticut, was used for the first time. It was brought on line after months of negotiation to help restore power after the massive blackout in the northeastern United States. Federal authorities have since approved the continued operation of the cable which uses ABB's HVDC Light (high voltage direct current) technology.

The underwater cable has been on the cards for 30 years. Its aim to provide a direct connection to the New England grid has been dogged by environmental concerns and, even after it was completed, it was some time before it could be brought online.

Addressing the environmental issue, the possible impact of an interconnector on the delicate aquatic ecosystem, was the opportunity that opened the way for ABB's HVDC Light solution.

GROWING DEMAND

The Cross Sound Cable project is designed to help operators in the region share their generating capacity and so reduce the risk of further blackouts. It will benefit Connecticut, New York and New England by encouraging electricity trading and promoting competition in the market.

The builder and owner of the project is Cross Sound Cable Company, a subsidiary of United Capital Investments which in turn is owned by United Illuminating Company and TransEnergie US. TransEnergie has been ABB's partner in the project.

The route across Long Island Sound was chosen as it would have less impact on people and property than a landline. HVDC, as opposed to HVAC, is well established as the preferred technology for this type of submarine cable.

TECHNOLOGY POWER

ABB's HVDC Light technology comes in unit sizes up to 330MW and for DC voltages up to +/- 150kV. It consists of converter stations and a pair of advanced technology cables.

Unlike conventional HVDC the ABB technology does not rely on the AC network's ability to maintain a stable voltage and frequency. This reduces the need for reinforcement in the local grid and provides extra flexibility in choosing the location of converters.

HVDC Light stations are compact, of modular design and blend into the surroundings. The stations are intended for unmanned and maintenance-free operation.

Prior to burial the two 125mm diameter cables were bundled and laid on the sandy seabed within a precisely defined corridor across Long Island Sound. A hydraulic jet plough was used to create a trench and bury the cables up to two metres below the seabed.

Jet ploughing creates minimal damage and is extremely fast and efficient.

COMPLETION

Work was finished in mid 2002 however it was not put into proper use until after the 2003 mid-August blackouts. It was granted full approval for regular use at the end of August 2003.

HVDC vs HVAC

- On cable links of 40km or more HVDC requires lower investment. On Cross Sound two DC cables could be placed in one trench as an alternative to three AC cables each of which would need its own trench.
- Long AC cables produce large amounts of reactive power, requiring shunt reactors at both ends. This can seriously reduce the active power capability.
- HVDC links can connect two asynchronous power grids and are ideal where it is not feasible to create a synchronous power connection.
- In an AC system it is not possible to directly control the power flow while an HVDC system allows rapid direct control of both direction and quantity.

Compact, high security MV switchgear offers improved operator safety

The ABB AX1 air-insulated switchgear for medium voltage distribution offers high operator protection, minimal maintenance and low life-cycle cost. This, coupled with its compact design, makes it ideally suited to small spaces that need high security.

Each AX1 panel is built up from three enclosure modules. The main circuit enclosure houses the primary switchgear functions with all live parts (12/24kV) inaccessible from the outside. Relay and control equipment are located within the operating enclosure and are accessible with the switchgear energised. The lower frame is where the power cables are connected.

To prevent personal injury and eliminate mechanical and thermal damage to the switchgear an arc eliminator short circuits any arc to earth within 5 milliseconds. The circuit breaker's operating mechanism can be removed for maintenance without the panel having to be taken out of service. And, because AX1 uses air as the insulation medium, only the switching devices contain SF_6.

Tubular busbars ensure a robust compact design and low surrounding magnetic fields. with low loss coil spring contacts used for easy connection between panels.

In addition to the individual panel computers which provide relay protection, monitoring, operating, measurement, communication and interlocking functions, a single support panel facilitates easy reprogramming/adjustments.

SafeRing is virtually maintenance free

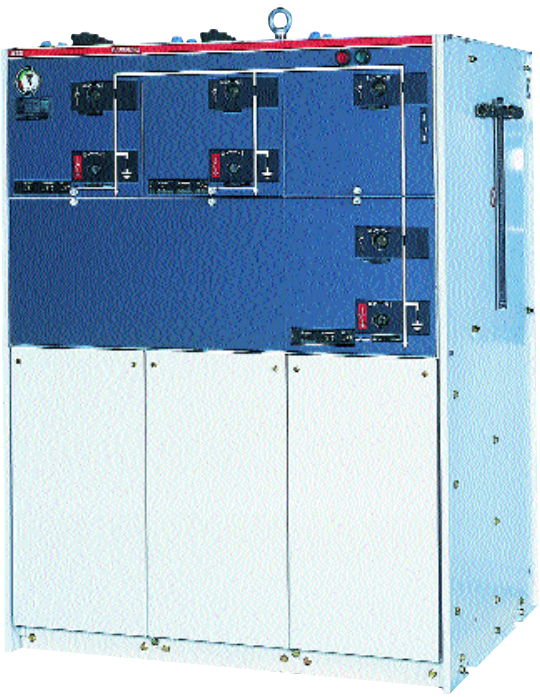
ABB's SafeRing is an SF_6 insulated ring main unit for the 12/24kV secondary distribution networks. The completely sealed system, which includes a stainless steel tank containing all the live parts and switching functions under constant atmospheric conditions, ensures a high level of reliability and personnel safety and is virtually maintenance-free.

Typical applications include compact secondary substations, light industry, wind turbines, hotels, shopping centres, office buildings, airports, hospitals, tunnels and underground railways.

The SafeRing concept offers a choice between a switch fuse combination and circuit breaker with relay for transformer protection. The switch fuse combination offers optimal protection against short circuits, while the circuit breaker with relay option offers better protection against low overcurrents. Circuit breaker with relay is always recommended for larger transformers.

SafeRing can be supplied complete with an integral remote control and monitoring unit. Other options include capacitive voltage indication, short circuit indicators, arc suppressor and motorised operation.

Available in ten different configurations, SafeRing offers a complete solution for secondary distribution networks when combined with ABB's SafePlus SF_6 gas-insulated compact modular switchgear.



The world's most powerful battery energy storage system, which uses ABB technology, has begun commercial operation in Alaska. The US$ 30 million system is expected to cut power blackouts by more than 60 percent.

ABB helps strengthen power supply in Alaska

Golden Valley Electrical Association (GVEA) in Fairbanks, Alaska has energised a new US$30-million BESS (Battery Energy Storage System), supplied and installed by an ABB-led consortium. The BESS is able to supply 40MW of power to stabilise the local grid and reduce its vulnerability to events like the recent blackout in the north eastern US and Canada.

At the heart of the world's most powerful storage battery system are two core components. First are the rechargeable Nickel-Cadmium (Ni-Cad) batteries, developed by Saft. Second is the converter, designed and supplied by ABB. The converter changes the batteries' DC power into AC power ready for use in GVEA's transmission system.

Ensuring a reliable supply of electricity is essential for a region where long supply lines and remote consumers are the rule, and where temperatures can drop to -51°C. At such temperatures, water pipes in homes would freeze in about two hours if the power supply failed.

The BESS comprises 13,760 rechargeable cells in four parallel strings to provide a nominal voltage of 5kV and a storage capacity of 3,680Ah. It is able to feed the power grid in an emergency with 40MW of power for six to seven minutes, or 27MW for 15 minutes. That gives sufficient time to bring diesel-powered back-up generators online. Other benefits include reduced emissions due to a lower reliance on spinning reserve as well as reactive power support and improved power quality.

The facility, which is about the same size as a football pitch, can ultimately accommodate up to eight battery strings. This gives considerable flexibility to boost output or prolong the useful life of the system beyond the planned operation for 20 years.

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