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FWWD

Summer 2006

FAST FORWARD WITH **ABB POWER SYSTEMS & PRODUCTS**



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Can the Energy Review consultation deliver?

Trevor Gregory
ABB UK Managing Director

- > The recently published Energy Review – *The Energy Challenge* report which outlines the government's policy and aspirations for the future has raised some important matters. How will the liberalised market respond? Can the broad aspirations outlined be realised?
- > Much of the technology to realise many of the ambitions stated are either available today or being researched and developed, so why are these not already being adopted by the liberalised market?
- > These questions highlight some of the fundamental reasons we have had another Energy Review so soon after the last one in 2003. The new market paradigm since liberalisation in the 1990s has focused on delivering lean and efficient organisations to compete in the marketplace. Market regulation in the electricity transmission and distribution sectors has delivered significant benefits to the end-customer in lower electricity prices. Commercial innovation delivered many of these efficiencies, while new technology has been neglected because it was seen as increasing risk.
- > With the new challenges of climate change, diminishing energy sources and a shift to renewables, clean coal, nuclear energy, demand reduction, energy efficiency and transportation fuel efficiency, technical innovation has moved centre-stage once again.
- > Many of ABB's products will play an important part in the delivery of energy efficient, environmentally friendly and economically feasible solutions to achieve the aspirations outlined in the Energy Review. You will find examples in the pages that follow of how ABB can help you to achieve the right balance for your business to deliver a path to a secure energy future.



Tom Smith, ABB project manager, outlines how detailed planning contributed to the success of National Grid's new 400kV indoor substation in north London, which is now in its second development phase

Planning makes perfect for north London substation

 In August 2003, ABB delivered a turnkey design-and-build project for a new 400kV GIS (gas insulated switchgear) indoor substation in north London. The capital's demand for electricity continues to soar. So as part of National Grid's ongoing programme to reinforce the power grid serving the London area, ABB is now back on site to carry out the second development phase by adding a further supergrid transformer and associated GIS equipment.

For both National Grid and ABB, the original three-year project was one of the most onerous we had ever undertaken from the planning and the environmental and community impact points of view. The site, in an inner-city urban regeneration area, is particularly challenging, as it backs on to the Regents Canal and the City Road basin, and is surrounded by domestic housing, a school and commercial industrial premises – hemming us in on all four sides.

As turnkey project manager, ABB was responsible for the complete engineering design and civil works, including the construction of the new indoor substation building, and installation and commissioning of the GIS switchgear and ancillary equipment.

SITE REMEDIATION

Before we could even think about construction of the new

substation, we had to demolish a four-storey office building. And since the first use of the site dated back to 1720, and it had at some stage been a timber yard, substantial remediation work was required – including the removal of some buried oil tanks.

Dealing with the contaminated land and ensuring that there was no risk of land or water pollution, or dust nuisance, presented a particular challenge. We worked very closely with the relevant environmental agencies to carry out regular sampling. We were also keen to be a 'good neighbour' to the local community. This meant keeping noise to a minimum, especially at weekends, and making sure neighbours were fully informed about what was happening through newsletters and letter drops.

LOGISTICS

The enclosed nature of the site also called for a great deal of advance logistical planning to enable us to move heavy plant, materials and equipment such as 200 tonne transformers in and out, while avoiding traffic disruption to both the roads and the canal, wherever possible. At the peak level, we had around 50 ABB people on site, while also having to direct other contractors.

For the first phase, ABB supplied four GIS switchbays and associated protection and control equipment, together with a 240MVA 400/132kV transformer, and carried out cable diversion work to link the new substation to a substation six miles away in east London. We proved throughout the project that we could help National Grid to meet tight schedules for

energisation and final hand-over, while delivering a first class service with minimum disruption. Those were the key factors that enabled us to win the contract for the current two-year extension phase, to supply and install a further supergrid transformer and four more GIS switchbays.

In an excellent example of forward planning, the extension phase was anticipated at the original project stage, so room within the indoor substation had already been allocated for the new equipment, which means that additional civil works have largely been avoided.

NICAP

One important development from the first stage is that the substation protection and automation systems for the extension will be based on National Grid's standardised NICAP (National scheme for Integrated Control and Protection) philosophy. By using pre-engineered, pre-tested and pre-approved solutions to interface the new bays to the existing substation systems, ABB will be able to achieve significant reductions in the delivery time for this element.

The extension will also see additional cable diversion work to connect the substation to the new indoor GIS substation that ABB has constructed in west London, together with an interconnection to a local MESH substation and connection to EDF Energy's 132kV substation.



The extension will include four more ABB GIS switchbays.

NICAP contract

ABB is to upgrade four substations with state-of-the-art automation and protection systems as part of National Grid's long-term asset refurbishment plan. This will add the latest technology to substation automation systems that are nearing the end of their 15-to-20-year service life.

The three-year contract, worth almost £12 million, will help further strengthen the UK's electricity network. The project will focus on upgrading the control and protection systems at four major substations linked to power plants in

the north of England and south Wales. It includes the design of three complex software schemes, as well as upgrading the protection systems for remote and stand-alone feeder circuits, involving work at about 15 different sites.

The new ABB equipment will be designed and tested according to National Grid's standardised NICAP (National scheme for Integrated Control and Protection) approach to protection and control systems built up from a number of pre-engineered, pre-tested and pre-approved elements. Since all the elements are pre-approved, there is no longer any need to attempt to complete the design approval process

during the project implementation phase. This standardised approach also makes procurement simpler and faster, thereby reducing the time needed to complete the order.

The Rail thing

The major international rail exhibition, *InnoTrans*, will take place in Berlin from 19-22 September. ABB will have an exhibition stand. Its number is 02.2/209. www.innotrans.com



Refurbished substation

A £2 million contract to refurbish and upgrade a 275kV National Grid substation on the Thames Estuary has been won by ABB. The project includes the supply and installation of five new ABB 400kV HPL SF₆ insulated puffer circuit breakers, to replace existing air-blast circuit breakers installed in the 1960s, as well as associated civil and connection works and interfacing with the substation control and protection systems.

The new ABB HPL circuit breakers, capable of switching short-circuit currents up to 63kA, will be installed on five circuits – three outgoing and two from the substation transformers. National Grid has specified them at 400kV to provide the substation with



the future flexibility to operate at the higher voltage.

The project will be finished by the end of 2007. In order to minimise potential

disturbance to customers, ABB will carry out the installation work in a number of phases co-ordinated with National Grid's planned outage programme.



Busbar circuits have been replaced with XLPE cable.

Continuity of power for M&S store

ABB has helped Marks & Spencer's Glasgow flagship store on Argyle Street to complete a seamless transition from its failing copper busbars to a new XLPE cable-based LV (415V) power distribution network. The key to ABB's successful execution of the £175,000 project was a phased approach, carefully co-ordinated to maintain continuity of the store's power supply so that no valuable

Technology sharing conference

» Euro TechCon 2006 is a two-and-a-half day event focused on technology and information transfer in Europe. ABB will be participating in the conference and exhibition which is being held at the Crowne Plaza Hotel, Chester, 28–30 November.

TechCon events have become important vehicles for sharing information on the operation and maintenance of high-voltage electrical equipment in the US, Europe, and Asia-Pacific.

Euro TechCon 2006 features workshops, panel

discussions and presentations. Topics will cover a broad spread of assets including transformers, switchgear, on-load tap changer and cables. Speakers will share experiences, practices and technology information.

Another important part of Euro TechCon is the opportunity to talk to the many exhibitors who use it to showcase their products and services. ABB will be one of these companies.

More information on Euro TechCon 2006 can be found at www.tjh2b.com



MV switchgear order for Network Rail

» Network Rail has awarded ABB an order worth around £3.2 million for 115 panels of ZX1.2 metal-clad gas-insulated MV (medium voltage) switchgear for substation and feeder sites in the Kent/Sussex and Wessex service areas. It is part of a project to renew existing assets in the South East territory. This is ABB's first contract with Network Rail's major projects and investment department.

The ABB ZX1.2 switchgear, which has technical acceptance from ENA (the Energy Networks Association) and Network Rail for use at 33kV for ratings up to 31.5kA and 2000A, will be installed at 26 sites to replace time-expired oil-filled switchgear that is now becoming unreliable. One of the key factors that enabled ABB to win this order was the ZX1.2's unique busbar plug-and-socket assembly. This enables fast installation on site, combined with a high level cabling arrangement at a convenient, easy to use height of 1.25m, hence reducing Network Rail's overall installation costs.



trading time was lost. At the same time, ABB's innovative approach to materials handling enabled the work to be completed with a minimum of scaffolding and without the need for cranes.

The work involved removing two 2300A resin-encapsulated copper busbar circuits and replacing them with XLPE (cross-linked polyethylene) cables.

Four single-core ABB copper cables, with a 630mm cross-section, have been installed for each transformer phase – a total of 16 cables per transformer, each around 30m long. The cables have been laid in steel trays (galvanised ladder racking) with a lid to prevent degradation by UV light. ABB also replaced the busbar terminations with new transformer switches capable of handling loads of 700A per phase.

The main transition activities were carried out during the store's Sunday shut-down periods - a window of just two and a half hours.

Removing the encapsulated copper busbars was a particular challenge as their weight (69kg per metre) required them to be cut out in individual one-metre lengths, while ensuring that they were held carefully to avoid them dropping from height. In fact, thanks to the great care taken with all aspects of the project, ABB received a glowing health and safety report.

MARKS & SPENCER

INTERNATIONAL NEWS

TAIWAN

Substation strengthens network
Taipower, the Taiwan Power Company, has placed a US\$20 million order with ABB for a 245kV indoor substation with gas-insulated switchgear. The LiLi substation will strengthen the power supply in the southern part of Taiwan, the heartland of its heavy industrial region.

AUSTRALIA

A switch for switchgear – Australia's power utilities are revamping their power distribution networks. In the process they are placing an estimated three out of four orders for secondary distribution switchgear with ABB. The products covered by recent contracts include 11kV ring main units, 11/22kV distribution feeders, 11/22kV air break switches, and 11/22/33kV outdoor circuit breakers. Among the utilities ordering ABB equipment are Actew, County Energy, Elsa, Energex, Ergon Energy, Integral Energy, Powercor, and T Squared.

SWEDEN

Connecting the country's largest wind farm

A US\$16 million contract to supply power cables to the Liligrund offshore wind farm has been awarded to ABB. The company will deliver more than 33 kilometres of single-core AC cable and armoured three-core AC cable with integrated optical fibre. The project covers underground and submarine XLPE (cross-linked polyethylene) insulated cables, cable laying and cable installation to interconnect 48 2.3MW wind turbines and transmit the power back to the mainland.

CHINA

US\$33 million power equipment contract

ABB has won a US\$33m contract to supply 110kV gas-insulated switchgear, 38kV and 10kV gas-insulated and air-insulated switchgear together with 220kV power transformers to help Tianjin Power Co satisfy the increasing demand of Chinese third largest city. The coastal district of Tianjin consists of a city of 10 million people with the largest seaport and commercial centre in northern China.

IRELAND

Supporting a single electricity market

ABB has won a major contract to provide the computer systems and software infrastructure for the new Single Electricity Market covering the whole island of Ireland. The new system will be used to trade electrical power consumed by all homes and businesses, amounting to more 25,000GW per year. It will provide a uniform power market across the Republic and Northern Ireland and is expected to improve competition and create a better environment for the deployment of power generation across the country when it comes into operation in July 2007.



Stuart Grattage, engineering manager for ABB's Power Systems projects business, outlines a radical approach to the commissioning procedure. So now, rather than being the last link in the chain, commissioning forms an integral part of the overall design and construction process

Commissioning – the buck stops here!

Commissioning is the final key stage of any substation design and build project. It is the first time that all the various equipment is tested as a complete entity. The pressure is on to prove that the project works safely, that it will feed power at the right levels and the protection and control systems function correctly. So it really is a case of 'the buck stops here' especially when working within a fixed outage period to get the project signed-off and handed over to the customer.

Traditionally the industry saw commissioning as the last link in the project chain – from winning the order, developing the design, carrying out civil works, installing the equipment and then calling on the commissioning team to prepare it for hand-over. It was not unusual for the commissioning engineers to arrive on site 'cold' with little prior project knowledge. They would then be bombarded for requests for test schedules, risk assessments, working documents and so on. Resulting in a great deal of work being done 'on the hoof', with little forward planning.

DOCUMENTED PROGRAMME

Towards the end of the 1990s, it had become clear to ABB that there must be a better way to do things. So we set up our commissioning management team to develop a more structured and fully documented commissioning programme – with the aim of ensuring that the commissioning engineers would be fully prepared when they arrived on site.

An important stage in the process was to develop a template for a commissioning file for each project. With some 20-plus sections, the folder includes accurate documentation of:

- Inspection and test plans
- Switching programmes
- Thermal rating schedules

- Stage-by-stage documentation
- Protection settings
- Emergency return to service
- Method statements and risk assessments.

The changes did not stop there. We decided to integrate the commissioning engineers within the project design and installation team. So rather than arriving on site and trying to make someone else's design work, the engineers can provide direct input to the design as it happens, right from the very start. Not only does this provide another pair of eyes to review the design, the feedback of practical site experience proves invaluable in ensuring that the systems will function as designed, and can actually help to shorten the commissioning process as well. We find this approach really helpful in developing the best value-added solution.

A PEOPLE BUSINESS

Naturally, the success of our new commissioning process comes down to finding

the right people. And we have worked very hard to build a team with the right qualifications, and authorisations, such as TP141, combined with experience in design, protection and control and site management. Crucially, we look for people who do rather more than just follow a set of rules, who can check what other people have done, and think round problems. We also aim to develop a close working relationship to support the customer throughout the project and to understand fully how they like to work.

Peter Milne manages the section and has been instrumental in setting up the department and the associated documentation. He brings to the role 25 years of experience with National Grid (previously the CEGB), where he held positions such as senior engineering officer. He is supported by commissioning team leaders such as Ken Rudge, who has 34 years of experience within roles such as asset management and incident and control management for Central Networks (formerly Midlands Electricity).





Site commissioning work is based on a structured fully documented programme.

PLANNING AHEAD

The ability to plan ahead is especially important when dealing with events such as an emergency return to service. Sometimes, for reasons completely out of our own control, we may lose the outage window we have taken – for example when a fault occurs at a neighbouring substation. So whatever stage we are at, the commissioning engineers must have a contingency plan to restore the circuit as quickly as possible.

EXPANDED SCOPE

As well as developing thorough stage-by-stage documentation that helps the commissioning process to operate as smoothly and efficiently as possible, our new approach is enabling us to expand our scope to offer extra added-value services that can relieve some of the burden on the customer. For example, it was usual for the customer to develop the switching programme to ensure that the new HV equipment was energised safely and correctly. This can now be performed by the commissioning team. Furthermore, we can now ensure safe energisation of LV systems through the development of our own authorisation process, where commissioning engineers become ABB nominated persons to carry out LV switching.

COMPLETE PROOF

In summary, we are finding that a growing number of customers welcome this new approach to commissioning, particularly in an industry where the integrity of the supply network is paramount. It provides a formalised structure at every stage, with all the work to be carried out fully documented and presented for customer approval before we arrive on site. It enables site experience to be fed back into the

design process, helping to develop the optimum added-value solution. It greatly reduces the potential of unexpected design issues arising on site, so that the commissioning process runs as smoothly as possible. Most importantly, it enables customers to be assured that the commissioning will provide complete proof that when the substation enters service, it will function safely and correctly, exactly as it has been designed.



Terry Smith, ABB's quality, health, safety and environmental manager, outlines how safety can be improved by better design

Designing for safety

ABB has a positive health & safety culture and is working hard to achieve zero injuries, zero work-related ill-health, and zero environmental issues. One of the main drivers for this emphasis on the design aspects of construction projects is the latest version of the Construction (Design & Management) Regulations, which comes into force next year.

So now we are taking the next step with a fresh look at designing for safety, not only to improve safety during the construction phase, but also throughout the whole asset life-time.

This approach fits in neatly with National Grid's 'Road to Zero' programme which has eight 'Golden Rules' for on-site working.

The current CDM regulations place specific duties on customers, designers, planning supervisors, principal contractors, contractors and employees to eliminate (if not reduce) risks to anyone constructing, cleaning or maintaining and using the structure and anyone else affected.

The main reasons for the emphasis on design can be found in HSE report 156 - Causal factors in construction accidents – which identified four ways that better design could reduce risk:

- Equipment designers (tools, plant and equipment) 'could have reduced the risk in 60 of the 100 accidents'
- Temporary works designers (scaffolding/formwork/falsework, etc.) 'could have reduced the risk of more than a third of the accidents'
- Materials designers (materials, their packaging, delivery methods) 'could have reduced

the risk of more than a third of the accidents'

- Permanent works designers (architects/civil & structural, mechanical & electrical engineers, etc.) 'could have reduced the risk in almost half of the accidents'.

The definitions of designers include 'those who analyse, calculate, do preparatory design work, design, draw, specify, prepare bills of quantities' as well as 'those who arrange for their employees (or others under their control) to do design'.

In view of the CDM regulations, ABB now demands that our designers deliver more health & safety features by designing-out hazards during the design phase. So we are implementing new processes to enable our design teams to identify, assess and manage risks logically.

SAFER DESIGN IN ACTION

Some practical examples show how some simple changes that ABB is already making can make a big impact. For example, oil sampling points on transformers are often placed in difficult to reach positions, close to the ground. But with a little thought there is no reason they cannot be re-sited for ease of access. Similarly, SF₆ pressure gauges on GIS switchgear were typically placed at a high level. New technology now allows sensors to be used in place of gauges with signals sent to a VDU at ground level. The cooling radiators for power transformers now have integral access platforms available to aid routine maintenance activities. Or, the whole business of servicing GIS equipment is made far easier and safer by construction of an in-built mezzanine floor. GIS maintenance is now based on the number of operations not time. This should mean that intrusive

maintenance is not required for the lifetime of the plant.

On a larger scale, a change in technology offers improved safety. So for a project that involves the construction of overhead live busbars – requiring the erection of steelwork and working at height as well as the need for traffic management, underground cables could represent a more elegant, safer solution with less disruption.

In essence, what we are challenging our designers to do is to think a little different, and step back to see the bigger picture. So that instead of the immediate traditional answer, they can develop a solution that contributes to improving the safety of the whole project – not just for those constructing it, but also for those using and maintaining the facility years from now.



An in-built mezzanine floor makes GIS servicing easier and safer.

The proposed European Offshore Supergrid will even out the bumps in the power supply. The Supergrid will transmit energy across Europe to where it is most needed and carry wind generated and other power. It will also more than double the UK's energy trading capacity and offer greater choice to consumers.

Watch out Supergrid is coming



The first phase of Supergrid will involve some 2,000 wind turbines.

Supergrid is an ambitious project that could help to solve an impending energy crisis in Europe. Proposed by the renewable energy company, Airtricity and actively supported by ABB, the first phase of the sub-sea Supergrid will cost around £15 billion to create. Eventually running from Spain to the Baltic Sea, the network will link national grids as well as delivering power from offshore windfarms.

The scale of the need for such an ambitious solution is highlighted by the fact that Europe's reliance on imported energy has risen from 20 per cent 50 years ago to 50 per cent today and is expected to reach 70 per cent by 2025. Global political, economic and social pressures mean that a radical solution is required if Europe is not to find itself highly vulnerable to external forces.

The new high-voltage AC/DC grid will perform two roles. It will carry energy generated by wind turbines to on-shore grid connections. And when the wind is not blowing the grid will carry electricity around Europe, making its power markets more efficient at energy trading.

When fully operational, wind energy is likely to be available at all times because the wind is almost certain to be blowing



somewhere on the grid at any given time.

The first phase will involve some 2,000 wind turbines generating some 10GW of power – 50 times more than today's biggest windfarms. The turbines will be located in the southern part of the North Sea between Britain, Germany and the Netherlands.

The power produced will be a European asset rather than belonging to any one country.

ABB technology, HVDC Light will be used to convey DC current over long distances to connect to the grid.

The Supergrid offers a unique opportunity for countries in the European Union to increase their security of supply.

What is more, the result will be a more integrated European market with the benefit of securely delivered power at lower prices. It will also enable the continent's grid to include a higher proportion of clean, but variable, wind power. This will make it easier for the EU to

achieve its aim of having 21 per cent of its electricity produced by renewable sources by 2010.

A major benefit of the Supergrid is that it links wind power generated across widely spread areas and smooths the overall output from this source.

In the first phase, DC power lines will take power westwards to the UK and eastwards to the Netherlands.

When the wind is not blowing, the lines will go into interconnect mode, using ABB's HVDC Light technology, to carry power in either direction. This would more than double the UK's energy trading capacity and bring greater stability to the grid, as well as giving consumers access to a wider range of power suppliers.

Visionaries see the European Supergrid ultimately being extended to reach North Africa where wind supply is more consistent. A scenario including wind and solar power supplying power to 50 countries and 1.1 billion people is already being considered.

Duncan Botting, head of technology and business development for ABB in the UK, has been through the Government's latest Energy Review and asks where does it go from here?

Energy Review concluded – what happens now?

>> The eagerly awaited outcome of the Government's Energy Review – The Energy Challenge – has now been published. The industry has been carefully reviewing the detail contained in the 218-page document to understand the likely policy that will be included in the white paper to follow.

There is a clear acknowledgement that investment in both the transmission and distribution electricity networks will have to rise to accommodate new renewable generation and new nuclear build. The opportunity to use technology to improve energy efficiency is a common theme throughout the report.

Micro-generation and Combined Heat and Power (CHP) from small, medium and large implementations will be encouraged. Energy efficiency will be promoted in a much more forceful manner using the Emission Trading Scheme (ETS) and other instruments.

Carbon capture and storage will be encouraged to assist in meeting the emission levels while planning processes will be reviewed to prevent excessive time delays to major infrastructure projects. Regulation will be reviewed – "The Government is clear in its determination to achieve its energy policy objectives through an approach that is consistent with the principles of good regulation."

Regional energy policy will be reviewed and strengthened with special focus on the powers of the Greater London Authority and the Mayor of London.

The Review confirms the importance of R&D and technology to deliver the future network benefits.

In reviewing new infrastructure the tricky area of planning and public consultation is tackled. The streamlining of planning regulations and consultations for major infrastructure projects is proposed, still ensuring fair but time limited consultation.

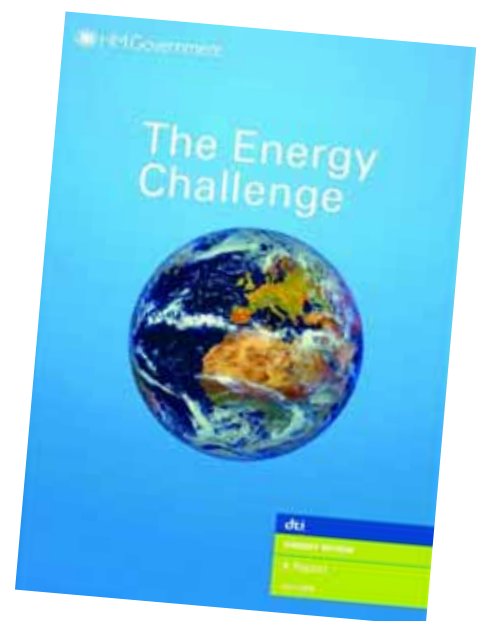
Further consultations will be developed for new nuclear build, planning applications (including gas projects), renewable transport fuel obligation, EU car fuel efficiency voluntary arrangements, review of permitted development rights for micro generation

and the energy efficiency commitment.

In its submission to the Energy Review, ABB identified many of the themes outlined above and offered examples of key technologies to make these aspirations a reality. ABB is already participating in many of the cutting-edge applications and technologies mentioned in the report through collaborative R&D and working groups throughout the industry, including regulatory and government-led advisory groups. Combine this with the products, solutions and services ABB already offers, and the vision painted in the Energy Challenge report has more than a passing chance of becoming a reality.

In the following issues of FFWD we will examine key technologies that ABB has already developed and how these can be utilised in your industry. Throughout each publication you will find examples and case studies of how the various technologies are already delivering benefits for their owners, operators and wider stakeholders.

For further information on how ABB can help your contribution to the Energy Challenge please contact Duncan Botting (duncan.botting@gb.abb.com) or see our comprehensive website at www.abb.com. We look forward to developing the future energy efficient



generation, networks and demand side solutions of the future with you. We are confident that together we can not only move towards a shared vision, but can also improve your operational efficiency and bottom line.



ABB's technology portfolio covers the full landscape of power transmission and distribution activities.

ABB has developed a new generation of low-voltage limiters for DC traction systems

Low voltage limiters

 ABB's new generation HVL (hybrid voltage limiter) low-voltage limiters which combine an MO (metal oxide) surge arrester without gaps and a thyristor-based low voltage limiter – have been developed to ensure effective protection of personnel and equipment in DC traction systems. They

fulfil all the requirements for voltage limitation, while reducing touch potentials to harmless levels.

THE NEED FOR LOW-VOLTAGE LIMITERS

In DC traction systems, stray currents can flow in the ground from the rails to other metallic

structures (such as drainpipes, bridges, fences and so on) where they can cause corrosion and considerable erosion of the metal. To avoid this problem, it is common practice not to have direct earthing of the rails where possible. However, this can lead to unacceptable potential rises and excessive touch voltages, in normal train operation and

especially in the case of a failure such as a broken overhead line or derailed pantograph. In such installations, protection for personnel has to be provided through low-voltage limiters (LVL).

THE NEED FOR OVER VOLTAGE PROTECTION

In addition to the touch voltages caused by failure in the supply system, impulse over-voltages caused by lightning or switching can occur on the rails. These impulse over-voltages can travel along the rails to the substations and damage the electrical equipment. So in addition to personnel protection, reliable over-voltage protection has to be provided for the electrical systems.

THE ABB SOLUTION – TWO DEVICES IN ONE

ABB's solution is a new device – the HVL (hybrid voltage limiter). The HVL combines the required personnel protection against touch voltages with protection of electrical equipment against lightning over-voltages. The HVL contains a metal oxide (MO) varistor in parallel to two anti-parallel connected thyristors. Over-voltages generated by lightning with a duration of some 10 microseconds are limited by the MO-varistor. Over-voltages with a time duration of 0.4 milliseconds and longer are limited by the thyristors to a voltage below 3V. The HVL is completely encased in silicon.



ABB's type EXK-0 gas insulated switchgear has been upgraded with new circuit-breakers to suit substation applications up to 145kV

New ABB switchgear is both compact and versatile

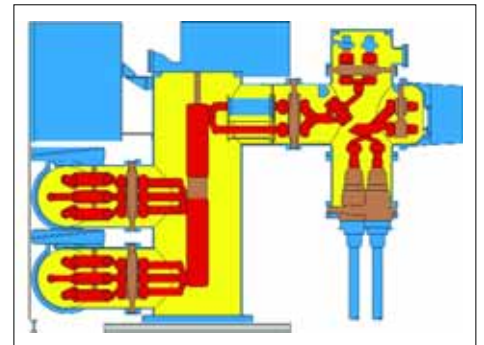
ABB's type EXK-0 high-voltage GIS (gas insulated switchgear) has recently been upgraded with ABB's new 'common' interruptor circuit breakers and is now optimised for applications up to 145kV. Now available with both conventional and digital secondary technology, the well-proven EXK-0 concept offers the ideal combination of compact design and flexibility in use to suit the most demanding substation applications.

The EXK-0 concept comprises a full set of functional bay modules (circuit-breaker, disconnecter, earthing switches, instrument transformers, etc.) for the construction of complete substations. The encapsulation of all high-voltage parts and the use of SF₆ insulating gas facilitates a very compact substation design. This makes it ideally suited to the creation of indoor substations offering high-levels of reliability and availability yet capable of blending into the local environment. Typical EXK-0 installations include containerised substations, in-building substations and even underground substations.

- feeder spacing of only 1.0 m
- weighs less than 2,500kg.

The EXK-0 switchgear is rated at 145kV, 2500A and 40kA and has been submitted for UK utility assessment for use in 132kV substations.

EXK-0 GIS is well proven in the UK at lower voltage levels, and made its debut in the British Isles as part of the 90kV Channel Island Link between Jersey and Guernsey, completed by ABB in 2000.



Sectional view of an EXK-0 bay.

EXK-0 FEATURES

Key features of the EXK-0 design are:

- new ABB 'common' autopuffer interruptor circuit breakers
- flexible gas-tight cable plug-in end unit
- HMB-1 hydraulic spring drive
- option for single pole operation
- optional advanced digital control (REF542 plus) for control, measurement, interlocking and protection

EXK-0 advantages

- space saving, extremely compact design
- small factory-tested units for ease of transportation
- flexible modules for innovative substation configurations
- short delivery and commissioning period
- maintenance-free equipment
- suitable for any 132kV substation

CONTACTS

For further information about any of these subjects please visit www.abb.com/ffwd or contact us as follows:

Substations	-	01785 825050	Transformers	-	01925 741469
HV/MV Switchgear	-	01925 741469	Asset Management	-	01785 825050
Automation	-	01785 825050	Wind Power	-	01785 825050
Service	-	0845 6011946	General Enquires	-	01785 825050
Power Quality	-	0151 3578400			