

insider



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AREVA Wind and ABB provide a way to harness wind energy

Modern business and industry rely on continuous clean power. ABB have a comprehensive range of power protection UPSs and voltage conditioning solutions to meet those requirements. Many modern loads do not draw a clean or balanced current from the supply. ABB's current conditioning products can clean problem currents - helping you to meet regulatory requirements and save on electricity costs.



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Insider



John Penny

General Manager
LV Power Converter Products (DMPE)

As I write this we are coming to the end of another busy year with many achievements and some challenges. The global economic environment has been difficult but this hasn't slowed the development of new and exciting products or their application around the world. Only by understanding our customer's points of pain and opportunities for improvement can we direct our engineering innovation and marketing efforts appropriately to ensure we provide real customer value and benefit. We can always do better but I am sure that after reading this issue you will see that we are definitely on the right path.

Considerable effort has been expended on understanding our customer's power protection requirements. As a result we now have a world leading portfolio of solutions to both voltage and current based power quality problems. This allows us to provide continuous clean po-

wer that gives business and industry increased security, productivity and yield while reducing energy loss. The modular nature of our commercial UPS products and industrial power protection solutions also mean availability and maintainability is improved and total cost of ownership is reduced. In the unlikely event of a module failure it is a great comfort for our customers to know a spare module can be quickly swapped with minimal cost and disruption.

On the power protection theme this issue of Insider launches the new STATCOM-I current conditioner. There have been many previous stories about the application of our more utility targeted STATCOM solutions. The STATCOM-I is based around the well proven PCS100 modular converter technology and contains many of the standard STATCOM features but is targeted specifically as a product to condition the current drawn by modern computer and industrial loads. This ability to correct reactive power, imbalance, flicker and lower order harmonics problems means again we can provide continuous clean power – this time current rather than voltage.

Datacenters have very demanding power quality requirements and you will be able to read how ABB's commercial UPS team have exceeded customer expectations with their application of modular UPS technology at Aareon's datacenter in Germany. Another industry sector with very demanding power quality requirements is semiconductor and flat panel display manufacture. Here ABB's industrial UPS-I UPSs are being applied in increasingly lar-

ge ratings. Please read about the latest 3 MW rated industrial UPSs, utilizing super capacitor energy storage, destined for a new three billion dollar LCD manufacturing site.

Away from power protection now to grid support, ABB's China team have been working with Prudent, a supplier of flow storage batteries, on PCS100 based converter solutions for smart grid application. Large amounts of energy can be stored in the battery electrolyte and the PCS100 based converters allow the control of charging, discharge and provide many smart grid features.

ABB's LV and MV converters continue to be used to save energy and reduce pollution in shore-to-ship power applications, converting the shore-based supply to the voltage and frequency required by the ship. ABB continue their leading position in this market space with more applications rated from a few hundred kVA to many MVA.

On the marine theme, increasing numbers of wind turbines are being installed offshore. You will be interested to read about the efficiency benefits provided by ABB's PCS 6000 based 5 MW converters applied in AREVA's M5000 turbines, which suit the requirements of offshore application.

Merry Christmas everyone and a happy new year for 2013!



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Clean power supply?

Certainly.



Power and productivity for a better world™ **ABB**

ABB's power protection range ensures a continuous, clean supply of power for industrial and commercial equipment, to ensure daily operations are uninterrupted. The state-of-the-art technology offered by PCS100 is successfully employed in a wide range of applications, including data centers, medical equipment as well as industrial production processes.

ABB Limited
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The power package

ABB has a complete range of power protection products that are available worldwide, to ensure continuous clean power.

ABB's power protection range ensures a continuous, clean supply of power for industrial and commercial equipment, to ensure daily operations are uninterrupted. Sustainable loads include data centers, medical equipment, computer rooms, and industrial production processes (semiconductor, automotive, etc.). ABB has a long history in the supply of power and power protection equipment, including modular industrial UPS products. ABB's modular UPS range has been further strengthened by the acquisition of the Swiss company Newave Energy and their range of innovative medium- and high-power commercial UPSs.

Modern society has become dependent on a continuous supply of clean electrical power. As economies continue to grow, so do technology trends and the need to continually keep up with the demand for the power protection of large commercial and industrial equipment. The first step in designing a power protection solution is to understand the types of power quality problems found on the incoming supply, and the nature of the loads to be connected. Sophisticated technology has touched every aspect of our lives to provide enormous benefits in terms of lifestyle, business, infrastructure and health. However this increases our reliance on electrical power – and often that power has to be completely free from interruption or disturbance for things to run smoothly.

A power supply can be affected by outages and voltage sags and swells. Power outages are not as common as power sags and, on the whole, power sags cost a company more valuable recovery time than infrequent power outages. Investing in power protection products eliminates the risk of power shut-downs and loss of critical information. Some industrial loads are relatively immune to these voltage fluctuations (switched-mode power supplies, drives, motors, etc.) and may require no additional power protection, especially if they are not critical. However others, such as critical systems or continuous process equipment where an outage results in significant restart time, do need protection. Certain loads, such as measurement or medical equipment, can be sensitive to events even within the normal grid tolerance of +/- 10 percent and these need special consideration. It is often possible to reduce the incidence of voltage outages, but sags are more difficult to eliminate. In a highly connected grid, any grid fault will propagate, having a negative impact on sensitive loads. Even the very best electricity grids in the world have residual power quality issues, as there is always an economic limit to what can be achieved.

These products complement ABB's range of industrial voltage conditioners and UPSs. ABB's PCS100 Power Converter System product portfolio includes products that offer very high efficiency and low ongoing cost of ownership. These offer shorter payback times and now make it more attractive to install mitigation equipment.

Commercial UPS

Newave Energy, a leading manufacturer of uninterruptible power supply solutions, was acquired by ABB in March 2012. This pioneering company introduced modular and transformer-less UPS technology in 2001. Today, these concepts form the foundation of the most important architectural trends in the UPS market. Although Newave has a comprehensive product portfolio containing both traditional free-standing and modular UPSs, the majority of its sales are now of modular three-phase UPSs. Today, close to 70 percent of ABB's sales are of modular UPS systems. Click [here](#) to view the UPS and power conditioning range.

Industrial UPS

The PCS100 UPS-I is a highly efficient (exceeding 99 percent) modular UPS design that utilizes a line-interactive topology. The PCS100 UPS-I product is designed to operate with motors and drives. The very rugged design suits even the most demanding industrial loads. A static switch (utility disconnect) with a high rating powers the load under normal conditions, with the modular inverter supplying the load when the supply voltage goes outside tolerance. If any inverter module were to fail, the system remains available at reduced capacity. This means that very high levels of reliability are achieved. Both ABB's commercial UPS technology and industrial PCS UPS-I products are designed for a much wider range of load power factors and they thus remove the hidden cost associated with de-rating and the need to oversize the selected UPS. Click [here](#) to read about how the PCS100 UPS-I is protecting a world class factory in Sweden.

PCS100 Active Voltage Conditioner

The PCS100 Active Voltage Conditioner (AVC) protects sensitive industrial plant and loads against voltage sags, imbalances and regulation issues. By continuously monitoring the incoming supply and comparing it with perfect sinusoidal reference waveforms, voltage vectors can be created using power electronics and injected in real time to provide a conditioned supply. The PCS100 AVC does not include any supercapacitors or batteries for energy storage, but instead takes energy from the remaining supply at unity power factor, with little impact. As voltage sags typically make up more than 90 percent of the problems that impact plant performance, the AVC provides a reliable, efficient and compact solution for industrial plant protection. With an efficiency that exceeds 98 percent, the PCS100 AVC provides a small footprint for companies that require an installation that consumes minimal space. Click [here](#) to read about the PCS100 AVC protecting Australasia's leading forest products company.

PCS100 STATCOM-I

Leading power factor is also a major problem for the standby diesel generator systems that feed many facilities. The PCS100 STATCOM, is an economical solution to this problem as it provides fast correction of leading VARs, imbalanced current and low order harmonics – all problems for the alternator systems found on these generator systems. With grid compliance established, this modular system offers highly efficient quality improvement for large industries. Click [here](#) to view PCS100 STATCOM-I success story in the mining industry.

The comprehensive range of power protection solutions and application expertise available from ABB mean the correct power protection solution can be applied to ensure reliable and cost-effective protection of critical loads.

Click [here](#) to view the Power Protection brochure.

To see further technology information please visit: www.abb.com/powerprotection and [UPS and Power Conditioning](#)





AG, based in Germany, is Europe's leading consultancy and system publisher for the property industry, based in Germany

Vital protection

ABB's Modular UPS installed at Aareon's data center in Germany.

Data centers are the heart of every service company. High availability, reliability and efficiency are the benchmarks against which all components are assessed in order to avoid the infamous single point of failure. A sudden loss of power will disrupt most business operations. But total mains failures or blackouts are not the only events that can trigger devastating effects. Power disturbances such as power sags, spikes and surges, noise and supply frequency changes can affect the operation of a critical load, leading to data or production loss, equipment failure or inability to trade.

Aareon AG is Europe's leading consultancy and system publisher for the property industry, focusing on optimized business processes for property companies and their environment. Aareon offers its customers a range of services, from consultancy through to software solutions. The Mainz-based company (Germany) has been active in the market for 50 years. There are 50,000 Aareon users managing over 9.5 million rental units.

In this kind of sensitive IT sector, any downtime would be catastrophic. But the ABB Conceptpower DPA UPS system selected for Aareon's Tier 3 main data center proves that quality and cost-effectiveness do not need to be mutually exclusive. Under the supervision of Herbert Stäudel, Head of the Data Center, a fundamental technology upgrade was carried out at the Aareon headquarters between May and August 2011. It goes without saying that a company like Aareon, whose core business is centered in the property industry, including all payment transactions, sets extremely high store on quality and reliability, especially when it comes to uninterruptible power supplies. Herbert Stäudel states: "We were really impressed by the modular structure, the small amount of space required, and the reliability of the system." Twice a year, the Aareon IT experts give the data-center components a thorough checkup by simulating a partial failure and a major one.

"At the end of the day," Herbert Stäudel explains, "the best UPS system is the one that carries out its work as inconspicuously as possible and that kicks in reliably in an emergency to keep the IT infrastructure going. Which is why we opted for this Newave product."

The excellent performance density at up to 342 kW/m² also saves valuable space. After all the technical details, it is worth considering the business aspects too. In this area, the Conceptpower DPA system recorded the lowest overall operating costs in the UPS sector, and the scalability of the infrastructure also means that the energy used for power supply and cooling exactly matches actual consumption.

The UPS can be easily and flexibly upgraded based on the motto "pay as you grow." This means that performance requirements can be continuously adjusted to the actual specifications and gradually expanded. The system can even be upgraded live, as all the hardware and software is conveniently integrated into every module. This technology is known as "Decentralized Parallel Architecture," or DPA for short.

Modular UPS technology

Systems based on a modular UPS topology currently represent the fastest-growing segment of the three-phase UPS market. Scalability, maintainability and availability are the key benefits offered by modular UPSs. Not all modular UPS systems are the same. The decentralized parallel architecture (DPA) of ABB's modular, double conversion three phase UPS systems minimize single points of failure. Each UPS module contains its own independent control and static bypass switch, meaning each is a UPS in its own right. Clever paralleling systems allow the modules to work as one system but without interdependence. In the unlikely event that one UPS module were to fail, the overall system will continue to operate normally but with one module less capacity. As it is usual for UPS systems to be over rated, this offers very high reliability.



Newave Conceptpower DPA with 400 kW and 10 minute autonomy across 12 m²

The ABB DPA concept provides each UPS module with its own independent static switch, rectifier, inverter, logic control, control panel and battery charger. Even the batteries can be configured separately for each module, if required, which makes the parallel system fully and truly redundant. With all of the critical components duplicated and distributed between individual units, potential single points of failure are eliminated. System uptime is further maximized by the true safe-swap characteristics of the modules.

The ABB modular products can operate in voltage-regulating, double-conversion mode where all power is converted from AC to DC and then back to AC. Alternatively, they can be set to an economy mode where the load is supplied very efficiently through the static switch and inverter operation is invoked only if the input supply goes out of tolerance.

ABB are now in the fortunate position of having a comprehensive range of power protection products to guard all types of loads from sags, surges and outages.

To see further technology information please visit: www.abb.com/UPS



PCS100 STATCOM-I provides a cost effective solution for industrial and commercial applications.



The PCS100 STATCOM has been widely applied to help the integration of renewables, particularly in wind farms. ABB's Napier-based R&D engineers have been busy enhancing the features of the STATCOM, not only to better service renewable energy integration requirements, but also solve many of the problems found in more standard industrial and commercial applications.

As a result, ABB has split the STATCOM into two products, one suiting engineered solutions for renewables and mining, and the STATCOM-I which is a pure product. The "I" suffix indicates

By injecting reactive current to stabilize the voltage, the STATCOM-I can provide a very cost effective solution.

that the STATCOM-I fits with the other products in the PCS100 Power Protection portfolio, including the UPS-I and the industrially focused AVC – Active Voltage Conditioner.

The UPS-I and AVC condition the voltage supply to critical load whereas the STATCOM-I conditions the current drawn by the customer's load, making it a good family fit.

Unfortunately many modern electronic loads and some industrial loads do not draw a clean, balanced, unity power factor current from the utility supply. For example, solid state DC motor drives will draw current with a relatively poor fundamental power factor and harmonics. Many low voltage AC drives will draw current high in the 5th and 7th harmonic current. Single phase switch-mode supplies are the most common loads in datacen-

ters and will often exhibit leading power factor; the three phase load can be quite imbalanced. These current related issues can create problems with the utility or even with the customer. For example, back-up diesel generator systems may not tolerate these problems and will malfunction or require expensive over-sizing.

The STATCOM-I can also help to mitigate some common supply voltage problems caused by fast changing loads, such as welders or arc furnaces, or fast changing imbedded generation such as PV solar. Common issues include annoying flicker of lights, voltages outside regulatory requirements or voltage unbalance, which is a particular problem for direct online connected motors. By injecting reactive current to stabilize the voltage, the STATCOM-I can provide a very cost effective solution.

ABB offers a complete product portfolio for direct connection to typical low voltage supplies (380, 400, 415, 480 VAC etc) rated from 100 kVAR to multi MVAR. The system's modular construction makes it highly configurable as well as functional.

To see further technology information please visit:
www.abb.com/energystorageandgridstabilization



PCS100 STATCOM-I Current Conditioner

Low voltage power converter solutions

Cleaning the current from industrial and commercial loads.

ABB's STATCOM-I is specifically designed to condition the current drawn by industrial and commercial loads. Part of the PCS100 family of power conditioning products, the STATCOM-I uses leading edge power electronic conversion to inject current into supply correcting for common problems such as:

- Unbalanced load current
- Fast varying current causing voltage flicker
- Low order harmonic currents
- Power factor problems including leading power factor
- Load current induced voltage drop

As a purely static device, the STATCOM-I provides extremely fast correction. Its modular redundant design makes it a very reliable, scalable and serviceable product, backed by ABB's global support network. Packed with new features to suit industrial and commercial applications.

Typical applications include:

- Datacenters with leading power factor problems (UPS and generator compatibility)
- Industrial loads correcting harmonics from 3-phase motor drives
- Light flicker caused by fast varying loads (welders, arc furnaces etc)
- Voltage regulation issues caused by PV Solar

www.abb.com/powerelectronics
(energy storage & grid stabilization)



Advantages

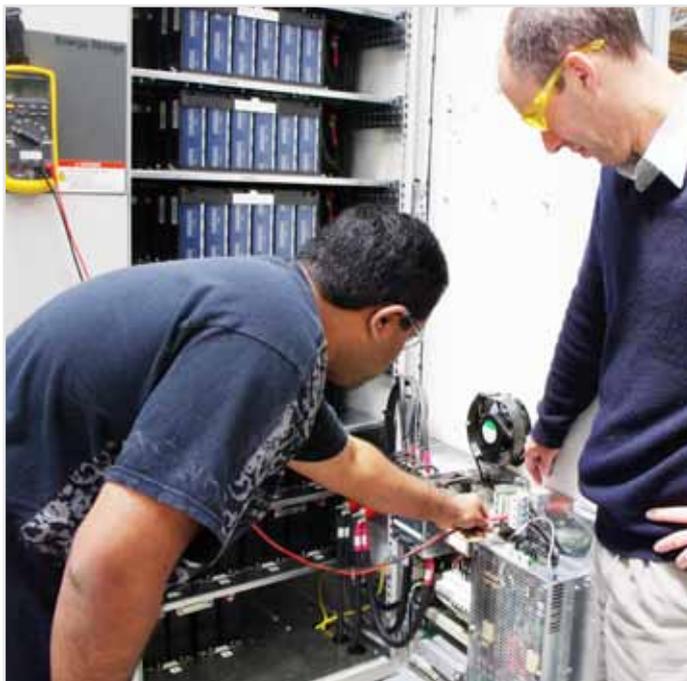
- Clean current
- Electrically low loss
- Highly reliable
- Scalable



An LCD testing line

Astronomical power

ABB provides an extraordinary amount of UPS power to protect a three billion dollar LCD plant company, based in China.



Power Electronics Engineer, Parthy Kumar checking the voltage rating of Ultra-capacitors

ABB are providing a power electronic solution of three 3000 kVA and five 1500 kVA PCS100 UPS-Is (Industrial UPSs), that will be installed in a leading South Korean electronics company based in China. The total order of PCS100 UPS-Is for this electronics giant amounts to over 16.5 MVA. ABB have also provided a significant number of PCS100 AVCs (Active Voltage Conditioners) and UPS-Is (Industrial UPS) to other LCD and semiconductor plants. This leading edge technology provides reliable protection of critical assets, to ensure voltage sags and swells are eliminated.

As industrial plants become more sophisticated, their reliance on a clean and continuous electricity supply increases. Modern Semiconductor and flat panel LCD manufacturing plants cost many billions of dollars to construct, and are susceptible to voltage events such as sags and short outages which can cost many millions of dollars in lost production per event. ABB have extended their successful PCS100 range of industrial grade UPS units to 3 MW and will supply three units of this rating and five of 1.5 MVA for a major new LCD facility.

The UPS-I can utilize a range of storage technologies but in this case, super-capacitors have been selected for back-up, rather than traditional lead acid batteries, due to their 15 year life and very high reliability. Longer term outages are an extremely rare event for these transmission-connected customers, so UPS back-up times of seconds, rather than the minutes more common for commercial UPSs, have been selected. The UPS-I is part of ABB's successful PCS100 family of power protection products which also includes the AVC (Active Voltage Conditioner) and STATCOM-I (Active Current Conditioner).

The 3 MW rated units to be supplied to the LCD facility in China have successfully passed testing in ABB's Napier New Zealand-based factory. Based around modular redundant inverter technology with a centralized industrially rated static bypass switch and additional electromechanical fail safe bypass, the UPS-I is highly reliable and serviceable. The heavily rated thyristors in the bypass circuit also mean that the overloads, current distortion and fault



Power Protection Sales Manager, Andrew Hiscock, analysing the data sheet before the PCS100 UPS-Is are tested

levels commonly found in industrial applications can be handled with ease. Reduced cost of ownership is also a major advantage of the single conversion UPS-I topology with better than 99 percent efficiency. This means significant energy savings when compared to many alternative power protection technologies.

Features

- Very high efficiency (typically 99 percent)
- Suited to industrial loads (motors, drives, transformers, tools)
- Modular design providing high reliability and short repair times
- Very high fault capacity compared with standard UPS solutions
- Extensive range of voltages available
- Small footprint design
- Custom storage solutions available
- Designed for the much more demanding requirements of industrial applications

The new LCD plant with a monthly capacity of 100,000 panels is expected to start production in January 2013 mainly manufacturing TV panels larger than 40 inches, which makes it the biggest South Korean project in China.

To see PCS100 UPS-I technology information please visit:
www.abb.com/powerquality





Unleash the battery power

China's first PCS100
ESS to be shipped
to Indonesia.

After months of effort between the MV (medium voltage) Drive and Power Electronics teams of ABB Beijing, the first PCS100 ESS (Energy Storage System) has successfully been implemented as part of Prudent Energy's battery solution in Indonesia. This solution will support Prudent's storage and release of new energy power and will strengthen grid reliability and overall performance. The PCS100 ESS is suitable for this application as it is grid compliant and provides the technology needed for smart grids.

Most countries generate electricity in large centralized facilities. These plants have excellent economies of scale, but usually transmit electricity over long distances and have a negative affect on the environment. Distributed generation, such as a micro-grid connected to the centralized grid, allows collection of energy from many sources. This in turn may give lower environmental impacts and improved security of supply. In the case of a major network event, where the energy supply from the interconnected grid may be interrupted, ABB have supplied Prudent Energy with a 400 kW PCS100 ESS to support the charging and discharging of the battery.

The PCS100 ESS will be implemented as part of Prudent's overall battery energy storage solution. This will provide reactive power to Sumba, a small island in eastern Indonesia that has poor power supply. Using the PCS100 ESS, the grid can support power to the island when the main grid is interrupted. This will in turn generate a smooth output of power, increasing the renewable accommodation capability. The PCS100 ESS battery solution can help energy storage devices, such as batteries, achieve stable storage and release of electrical energy through frequency modulation and voltage regulation. For a power system, PCS100 ESS is just like a conventional synchronous generator featuring power electronics and advanced control

The PCS100 ESS will be implemented as part of Prudent's overall battery energy storage solution.

technologies. Its inertial characteristics depend on the internal control system, which is aligned to the grid frequency and its change, and energy conversion is recognized on this basis.

This is the first project that incorporates Prudent's VRB (Vanadium Redox Battery) "flow battery" technology with the PCS100 ESS, and is an important milestone for ABB. The PCS100 ESS works by charging the VRB battery voltage up to the designed range, helping regulate the power flow by discharging power to the grid during unstable events, such as extreme weather conditions.

Along with the PCS100 ESS, ABB supplied a circuit breaker, transformer, DCS800 drive and a PLC (programmable logic controller). The DCS800 system that was provided by ABB recognises the pre-charging function. It has a three-winding transformer, that can reduce harmonics, making the overall package provided an effective grid compliant option. ABB's leading edge technology made the total solution easy for Prudent Energy to utilize. The extensive support and global service offered by ABB, mean that the PCS100 ESS is a product that Prudent Energy can rely on. This will enable an ongoing relationship between ABB and Prudent Energy for future energy storage solutions, which will be offered in other locations.

Kong Fanshi, Project Manager for ABB Beijing Drive Systems states, "Prudent Energy believes in the design and service ability of ABB, and thus a reason why we were able to have this



PCS100 ESS 400 kW to be used as part of Prudent Energy's overall energy storage solution

opportunity. We also provided the commissioning and follow-up of service on time."

Prudent Energy is the designer, manufacturer and integrator of the patented Vanadium Redox Battery (VRB®) Energy Storage System – a long-life, environmentally friendly "flow battery" system. Founded in 2007, the Prudent Energy group of companies maintains corporate offices in Bethesda, Maryland, and Beijing, China, with research, development, and assembly facilities in the United States, Canada and Asia.

For further information please visit:

www.abb.com/energystorageandgridstabilization





Shore-to-ship power

ABB's turnkey solution reduces portside emissions.

In the shipping industry, harbor areas have been identified as a prime candidate for enabling significant emissions reductions. With this in mind, port authorities, ship-owners, industry suppliers and regulators are now focusing on the decade-old technology known as shore-to-ship power, for which universal electrical standards are on the verge of being ratified by IEEE, ISO and the IEC. Onshore power supply allows commercial ships calling at ports to turn off their diesel engines and tap into cleaner energy sources. Having successfully delivered the world's first shore-to-ship power connection to the port of Gothenburg, Sweden in 2000, ABB not only has the technology but also the experience, required to make the complete connection, onboard and off-shore.

With ABB's shore-to-ship power connection, a large cruise ship can cut fuel consumption by up to 20 metric tons and reduce CO₂ emissions by 60 metric tons during a 10-hour stay in port.

Over 90 percent of the world's goods are transported by sea, and although shipping is a highly efficient means of transporting cargo with lower CO₂ emissions than trucking and far lower emissions than air transport, the industry is still responsible for around four percent of all global CO₂ emissions (aviation accounts for two percent). With shore-to-ship power connection technology, a large cruise ship can cut fuel consumption by up to 20 metric tons and reduce CO₂ emissions by 60 metric tons during a 10-hour stay in port – equivalent to the total annual emissions of 25 European cars. It is no surprise then that interest in shore-to-ship power is growing, not only for environmental but also for economic reasons. With a shore-based power connection, a ship is able to turn off its engines without interrupting its port services, such as loading and unloading, hotelling or any other activities that consume power at berth. The connection and disconnection of the ship takes as little as 15 minutes, and administration of power supply and consumption is handled by the port operator.

Establishing a shore-to-ship power connection necessitates investment by both ship owners and port authorities or terminal operators in the form of either a retrofit of existing assets or construction of new ones. The ship needs an additional electrical switchboard, cables connecting it to the ship's main switchboard, and, in many cases, a step-down transformer. The port requires a substation with breakers and disconnectors, an automated earthing switch, a transformer, protection equipment such as transformer and feeder protection relays, communications equipment to link ship and shore, and in most cases a frequency converter to adapt the frequency of electricity from the local grid to match that of each vessel. Further, a cable-management system is needed for either the port or the ship.

Such technology is readily available, and given the emission reductions implicit in onshore power as well as the technology's imminent standardization, the solution is gaining attention. It is increasingly appearing in regulations and discussions in the European Union, the United States and within

the United Nations' organization for maritime policy, the IMO. EU directive 2005/33/EG, which went into effect January 1, 2010, exempted ships using shore-based electricity from a rule requiring use of reduced sulfur-containing marine fuels while in port. In the United States, legislation proceeds state by state; California, a regulatory forerunner, has begun to require shore-side electricity connection for some ship types. At the IMO level, new restrictions on the allowable sulfur content in fuels improves the economical case for onshore power, without explicitly mandating or supporting it. Onshore power supply is a well-established technology, which is already available at several ports, including those in the United States, Belgium, China, Canada, Germany, Sweden, Finland and the Netherlands. With a new set of global shore-side electricity standards on the verge of ratification, the practice is expected to rapidly expand for all major types of ships and ports worldwide.

Regulations point to onshore power

As regulators realize that pollution stemming from the shipping industry is having a major impact on public health as well as costs, they have increased their attention on this industry. Since at least the late 1980s, the IMO has focused on how to reduce the environmental impact of shipping (oil spill prevention has a much longer history). National, city and port authorities are also initiating regulation of emissions generated by ships. Currently, there is no law or rule requiring ships at port to connect to an onshore power supply, but standardization may well lead to increased adoption of onshore power technologies.

Evaluating the benefits

For port authorities and ship owners, the merits of shore-to-ship power supply versus the competing emissions-abatement technologies are debatable. The operational profile of the ship also has a big impact – for example, a ferry calling into a port everyday is quite different from a container vessel calling into a port once a month. Thus, it is difficult for investors to calculate long-term return on investment as the regulatory picture changes. Fluctuations in the price of

marine bunker fuels compared with shore-based electricity also influence calculations. The environmental profile of electricity generated by power plants on land versus ships' diesel engines running on bunker fuels is one of the main advantages of shore-based power. Generally, when power production can be reduced to as few producers as possible, these producers can be more easily and efficiently optimized to reduce environmental impact.

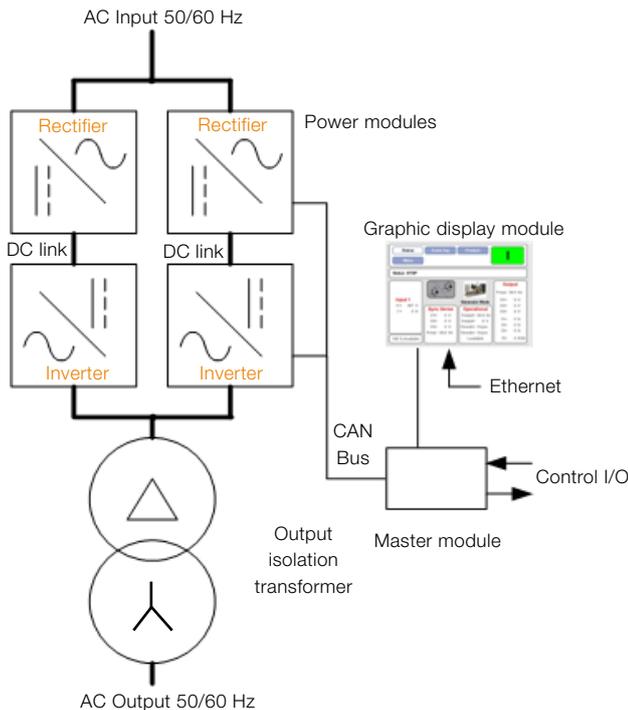
Another argument for shore-to-ship power is the advantage of jurisdiction. With onshore power arrangements, regulators can deal with the specific, local problem of pollution with a specific, local response. Efforts to capture emissions from auxiliary diesel engines can be used throughout a ship's operations worldwide, but it takes away any scope of action by local or regional authorities. For ports, the ability to supply power to ships at berth enables them to establish a more efficient and powerful overall electrical supply as a utility. The use of state-of-the-art frequency converters can provide both a stabilizing effect on the local grid and an improved power factor. Effectively, this means the local power system experiences lower losses.

Onshore power supply has an additional advantage over other emissions abatement technologies in that it reduces both noise and vibration in port areas. This is a benefit to merchant mariners, passengers and crews, port workers and the surrounding community of ports, particularly large ones. Some ports have encountered growth constraints related to their environmental permits, as their operations' emissions, noise or vibration levels have become too high. Finally, shore-to-ship power is easily scalable; infrastructure investments are sustainable over decades with long-term revenues and relatively little maintenance. For each new port that invests in shore connections, the cumulative value of the technology increases by a factor, as more and more ships and sailing schedules are impacted.

A shore solution

Shore-to-ship power connections have been implemented in approximately two

Single line diagram of PCS100 SFC



ABB's PCS100 SFC technology

The PCS100 SFC allows connection of 60 Hz powered equipment to a 50 Hz supply network and 50 Hz powered equipment to a 60 Hz supply network. Additionally the PCS100 SFC can convert the supply voltage to a different voltage to match the requirement of the load.

The system functions by converting the input AC power through a sine-wave rectifier to a DC link and then through an AC sine-wave inverter to produce a clean, full sine-wave output at the new frequency and voltage. For correct operation of the power electronics, an isolation transformer is required as part of the SFC system. The isolation transformer can be applied to the input or output of the SFC.

The PCS100 SFC system is constructed using power electronic modules. These state of the art modules operate as rectifiers to source sinusoidal current from the supply, and inverters to reproduce the AC waveforms on the output.

dozen port terminals worldwide starting in 2000, and on over 100 ships ranging from cruise vessels to oil tankers and container ships. Countless other port operators and ship owners are assessing an investment in the technology, on the condition that global standards for shore connection are realized. Acceptance of and investment in shore-based power supply infrastructure has been limited due to the lack of a global standard. A public specification is already available, and this is being used by ship owners and port authorities to assess future installations. Existing technology solutions are largely built up around these specifications. Regulatory moves by local, national and international bodies that spur adoption of shore-to-ship power supply include taxes on fossil fuels, requirements to marine fuels and stipulation of onshore power supply (or alternatives with equivalent emissions reductions).

Shore-to-ship power supply is in most instances a practical and effective means to reduce emissions in heavily used port areas. The technology is available, but its adoption is contingent upon it being available at a large number of ports, and in a large number of ships.

ABB's solution

As a technology pioneer in high voltage installations for marine applications, ABB offers Static Frequency Converters (SFCs), which are a safe, economic and

highly efficient solution converting the grid electricity to the appropriate load frequency. This leading-edge frequency conversion technology guarantees a seamless automated power transfer of the ship load from the onboard power plant to the onshore source and back.

This solution contributes to a significant reduction of fuel and lubrication oil consumption, which means less pollution and improved financial benefits. Shore-to-ship power is especially applicable to ships operating on dedicated routes, and vessels that consume large amounts of power while in port. This could bring real benefits for terminal operators whose ferries berth each day for a fixed number of hours.

The PCS100 SFC is extremely flexible with regard to paralleling with other voltage sources, either other generators or multiple SFC units. Parallel load sharing is achieved using frequency and voltage droop profiles programmed into the converter. This allows the converters to share power with other systems without the need for any additional communication signals. One unique feature critical to the reliability of the converted output supply is the built-in redundancy capability which is an intrinsic feature of the modular system design. In an unlikely event where either a single rectifier or inverter module encounters a fault, and

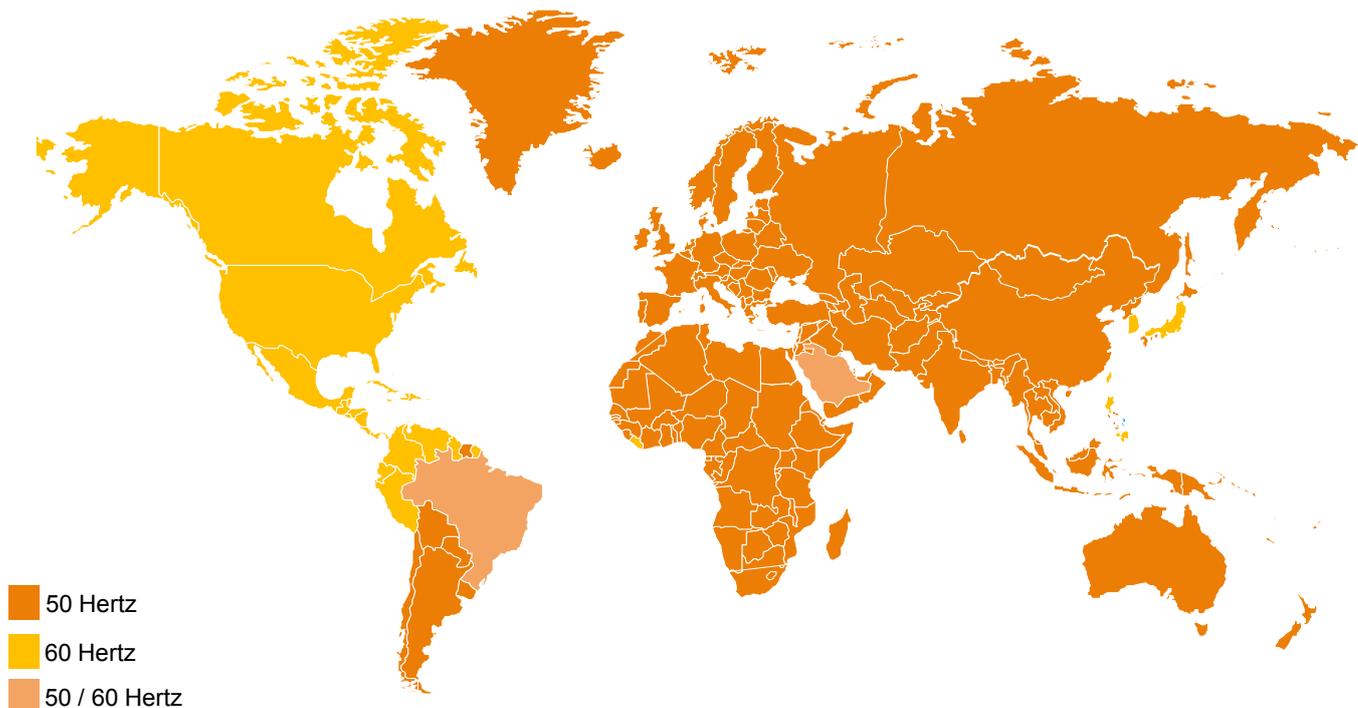
stops functioning, the master controller that oversees the power modules will provide a warning notification but allow the system to continue to operate.

Low operational impact

An advantage of the system is its superior availability due to high reliability and low maintenance (MTTR<30min), which leads to low operational costs. The cost of ownership may be further reduced thanks to the possibility of incorporating renewable energy sources, such as wind or hydro power, solar panels and fuel cells, which can open up a range of new opportunities. ABB's offering includes comprehensive turnkey shore-to-ship power solutions, from electrical infrastructure on ships (retrofits or new installations) to electrical infrastructure in ports, as well as connection and control solutions to ensure personnel safety and seamless power transfer.

www.abb.com/powerelectronics/grid-interconnection-products





PCS100 Static Frequency Converter (SFC)

Now the whole world is at the same frequency

ABB's PCS100 (static frequency converter) is the answer to bridging the gap in today's industry environments, where equipment has different voltages and frequencies. Providing the ability to shift power to and from the 60 Hz to 50 Hz grids, the PCS100 is the economical answer to running your industrial equipment overseas, or your overseas equipment here.

Typical applications include:

- Where load frequency is different to the local supply
- Relocation of industrial plants; and
- Supplying power to docked ships

ABB offers a complete product range from 125 kVA to multi MVA. The system is internally configured as a parallel arrangement of modular rectifiers and inverters all controlled by a central master controller. Each rectifier draws a clean sinewave current at unity power factor from the utility supply. Each inverter produces a clean sinewave voltage to supply the output load. The modular design makes the system compact and highly serviceable. In the unlikely event of a failure, individual converter modules can be moved and replaced with minimal downtime.

www.abb.com/powerelectronics
(grid interconnection products)



Advantages

- 50 Hz to 60 Hz and 60 Hz to 50 Hz conversion at any voltage via transformers
- Unity power factor rectifier with a THDi of < 3%
- High efficiency 95% typical
- Overload capability of up to 200%
- Able to parallel with multiple PCS100 SFC or other generators
- Very high system availability through advanced power module redundancy
- Provides output immunity to input disturbances (voltage sags, frequency shifts)



Wind power

AREVA Wind and ABB usher in a more reliable and efficient way to harness wind energy.

AREVA Wind, a subsidiary of energy multinational AREVA, designs, manufactures and assembles a 5 MW M5000 wind turbine that uses a medium voltage hybrid, fully integrated generator-gear system. “Most turbine manufacturers will soon move to hybrid designs over direct drives,” says AREVA Wind CEO Jean Huby. The fully-integrated system operates at medium speed and offers a compact design together with ABB’s high-efficiency permanent magnet (PM) generator, which maximizes offshore performance. This solution, Huby says, will mean that M5000 turbines will need less maintenance than other models. He proudly cites an overall availability rate in excess of 98 percent.



AREVA Wind M5000 nacelles in Bremerhaven ready to go offshore

Reliability first

The medium speed gearbox of the M5000 does not need any fast-moving sections, only the slow rotating stage thereby improving the system's overall reliability, especially at over 5 MW. Together with the ABB generator-converter package, the system is fully optimized for future advanced grid code compliance.

"Modern direct drive machines also run on PM generator units," says Raimo Sakki, R&D Manager of ABB's wind power generators. The difference, he says, is that they are larger and heavier than their hybrid counterparts. By comparison, the generator in the M5000 has roughly 80 percent fewer active part components (magnet pieces and coils) than an equivalent 5 MW direct drive machine. "The fewer components you have, the more reliable your system," says Sakki.

The same applies to the PCS 6000 Wind MV power converter, supplied with the generator. With only 26 power semiconductors, the converter clearly advocates the "less part count" concept. The medium voltage converter is very efficient (overall efficiency of 98 percent) and enables grid compliant wind turbine operation up to 9 MVA. Its compact design and reduced cabling allow flexible installation and cost savings for the customer.

A bright and windy future

By the end of 2013, AREVA will have installed 120 turbines at two North Sea wind farms – Trianel wind farm Borkum (BWII) and Global Tech I – each using ABB's PM generator, medium voltage power converter and medium voltage switch gear.

The fact that ABB's generator-converter package is medium voltage (3300 V) is another distinct advantage over competitors. "Ninety-five percent of all our competitors are working in a low voltage range, meaning they have to handle big currents and suffer more electrical losses," said Wilhelm Janssen, Head of the E-Power department at AREVA Wind.

Efficient solution

"Permanent magnet generators have no excitation losses because magnets are used in the rotor instead of copper windings to create an excitation field. This makes the generator smaller and extremely efficient, especially with partial loads at low wind," explains Sakki.

But in order to maximize the benefits of the ABB PM generator, close cooperation with the turbine and gear manufacturers is needed to solve mechanical design challenges. "AREVA has now got very positive field-tested offshore experience from this optimized ABB generator-converter system," says Adrian Zurbruggen, ABB key account manager for AREVA Wind. Zurbruggen speaks of the common vision that ABB and AREVA have for jointly scaling up offshore wind power. "We are very glad to have a key customer and partner in AREVA," says Zurbruggen.

Your reliable partner

In the wind power sector, ABB is the largest worldwide supplier of electrical solutions and a market and technology leader in generators, converters, circuit breakers / contactors, motors, transformers and HVDC.

For further information please visit:

[www.abb.com/PCS 6000 Wind](http://www.abb.com/PCS_6000_Wind)

Or to watch the movie on AREVA Wind project, please click [here](#)



PCS100 Product training 2013

Register your interest now for 12-14 March 2013



Enhance your technical ability and knowledge in the PCS100 product range. Receive the benefit of interactive practical training with real devices for demonstration purposes and functional exercises.

Product training

Products, applications, markets and technical basics

- Power protection
- Frequency conversion
- Grid connect interfaces

Marketing

- PCS100 tools and support

Hardware

- Power modules, aux.module, interfaces

Control modes, interfaces, options

- Power protection
- Frequency conversion
- Grid connect interfaces

Order handling process

- PCS100 sizing and pricing

PCS100 outlook

- Ongoing and future developments

Who should attend?

ABB channel partner sales and service engineers.

Training locations

ABB's low voltage power converter product training is conducted in our well equipped manufacturing and R&D facility in Napier, New Zealand, by highly qualified engineers and instructors.

Enrolments

Register your interest for any one of our courses via email to: pq.supportline.nz@nz.abb.com

Confirmation

Confirmation of acceptance and course information will be sent approximately two weeks before the start of the course. We will inform you by email or phone if there are no vacant places.

Course program

The course program and all related information about the course times and venue are sent to the participants with the confirmation. The course normally runs from 9.00 a.m. - 4.00 p.m. over a three day period.

Reservations

We reserve the right to change any course schedules, programs and their contents. A course could be cancelled due to minimal enrolment. The maximum number of students varies between 10 - 12 persons.

Cancellation

In the case of cancellation, inform us as soon as possible. This will allow another applicant to attend the course. Your place on a course can be transferred to another person in your company or department.

Training schedule 2013

| Course | Day one | Day two | Day three |
|---------------------|----------------------------------|-----------------------------|---------------------------------|
| One | 12 March | 13 March | 14 March |
| Two | 14 May | 15 May | 16 May |
| Three | 13 August | 14 August | 15 August |
| Four | 12 November | 13 November | 14 November |
| Agenda Am | PCS100 product platform overview | PCS100 frequency conversion | PCS100 sizing and pricing tools |
| Agenda Pm | PCS100 power protection | PCS100 grid connection | Outlook /future developments |

Service and commissioning training 2013

Register your interest now for 19-21 March 2013

Your knowledge. Your power.

ABB is a leading supplier of power electronic systems. This extensive experience and history of innovation helps customers around the world to improve plant performance and production.

Our customer awareness means that we are committed to supporting customers globally in their plans for growth. ABB offers a wide range of professional training courses adapted to meet the needs of customers and partner channels.

Benefits of the training

Service and commissioning training courses give valuable support to increase return on investment, reduce costs in down time and improve skills and motivation of personnel.

Training participants profit from our extensive experience and modern training infrastructures which enable them to:

- efficiently operate and maintain ABB's PCS100 low voltage power converter systems
- extend the lifetime of the product

Training locations

ABB's low voltage power converter product training is conducted in our well equipped manufacturing and R&D facility in Napier, New Zealand, by highly qualified engineers and instructors.

Course profile

Our service and commissioning training courses are aimed at qualifying maintenance engineers to undergo unsupervised first level support of ABB's PCS100 applications. The main goal of the course is to learn how to operate, troubleshoot and maintain the system.

Upon completion of the course, maintenance engineers will be able to locate and identify hardware components, download fault loggers and important information for first analyses by support personnel, replace parts and perform preventative maintenance. Trainees will gain practical experience using available tools and techniques through organised practical exercises.

Who should attend?

ABB partner channel and customer service engineers.

Confirmation

Confirmation, reservation details, and all related course information including schedule and venue details will be sent approximately four weeks before the start of the course.



Enrolments

Register your interest for upcoming courses via email to: pq.supportline.nz@nz.abb.com

Training schedule 2013

| Course | Day one | Day two | Day three |
|-----------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| One | 19 March | 20 March | 21 March |
| Two | 21 May | 22 May | 23 May |
| Three | 20 August | 21 August | 22 August |
| Four | 19 November | 20 November | 21 November |
| Agenda a.m. | PCS100 platform service introduction | PCS100 service power protection | PCS100 service grid interconnection |
| Agenda p.m. | PCS100 platform service detailed | PCS100 service frequency conversion | Outlook / future developments |

Power from within



Project feature

6. Energy saving solution

ABB provides a battery solution to one of Switzerland's largest energy distributors

Industry watch

10. Shipping Industry

Successful grid interconnection for a better world

12. Semiconductor demand increasing

PCS100 AVCs making their mark in the semiconductor world

Project completion

14. Medical intelligence

Samsung Medical hospital in Korea leading the way for the future

16. Going green

The Swedish port of Ystad embraces PCS 6000 technology

Renewable energy



Project feature

6. Environmentally sustainable

ABB provide a grid stabilizing solution to Whitlee wind farm in Great Britain

Project completion

8. Fakkem wind farm

ABB and Vestas provide a complete package for an onshore wind farm

10. Limitless power protection

Successful installation for the semiconductor industry

Industry watch

12. Connecting to the grid

Reducing pollution at a shipyard in Bahrain

Newwave feature

14. Critical IT infrastructure

Authentic UPS systems

To receive one of the back issues shown above email: sophie.benson-warner@nz.abb.com



PCS 6000 STATCOM. Always grid code compliant - every turbine, every wind park.



Clean and stable electricity feed into the public transmission system is a demanding requirement of renewable energy generation. ABB offers solutions out of a comprehensive range of reactive power compensation products and customized systems to meet these challenges. The PCS 6000 STATCOM is a field-proven, reliable, robust and efficient unit that achieves a stable power grid, at the same time fulfilling all grid code requirements. Contact us to learn more about the ABB STATCOM solutions.

www.abb.com/windpower

Power and productivity
for a better world™

