

Innovation highlights

ABB's top innovations for 2016

Research and development is about discovering and shaping the future of technology. Every year, hundreds of new discoveries or improvements to existing discoveries come out of ABB's labs. In the following a

selection are presented. Some of these innovations are revisited in full length articles in this and upcoming issues of ABB Review.

An alternative to SF₆ as an insulation and switching medium

For decades, the unique properties of sulfur hexafluoride (SF₆) have made it popular as an insulation medium for electrical switchgear. However, SF₆ is a greenhouse gas and there are increasing life-cycle management costs associated with its use.

The considerable efforts made by many research groups to find SF₆ alternatives with lower environmental impact but with insulation and arc interruption properties as good as those of SF₆ have, until now, proved fruitless.

However, ABB has developed an environmentally friendly alternative, with properties similar to SF₆, with a gas mixture based on a product from the company 3M called Novec 5110 Dielectric Fluid – a perfluorinated ketone with five carbon atoms.



The fluoroketone-based gas mixture for switchgear applications was developed in collaboration with 3M. This fluorinated molecule decomposes under ultraviolet light in the lower atmosphere, giving a lifetime of around 15 days, versus 3,200 years for SF₆. The global warming potential (GWP) of the gas mixture is below 1. In a joint pilot project with ewz, a leading Swiss utility, the world's first

gas-insulated switchgear (GIS) installation to use the new gas mixture was recently commissioned in a substation in Zurich, Switzerland. Altogether, eight high-voltage GIS bays and 50 medium-voltage GIS bays using a gas mixture based on the ketone were installed in the substation, which is adjacent to the ABB GIS factory.

A light UPS that won't take downtime lightly

ABB's power protection portfolio for industrial applications spans a range of products including static frequency converters, voltage and power conditioners as well as uninterruptible power supplies (UPSs) for industrial markets. The new light industrial UPS PowerLine DPA is an online double-conversion UPS for lighter duties – such as a factory with less harsh conditions.

PowerLine DPA encompasses a modular approach based on ABB's unique DPA (decentralized parallel architecture): In this approach, each UPS module contains all the hardware

and software needed for autonomous operation. The UPS power modules are swappable online, implying zero downtime. PowerLine DPA offers a redundant system configuration, sharing and protecting the load. The solution is fault tolerant and has no single points of failure.

PowerLine DPA secures the power supply to critical industrial processes that require a high level of safety and protection. Its robust design is suitable for industrial plant environments that have high ambient temperatures, dust, moisture and corrosive contaminants. The modular architecture of the PowerLine DPA provides high availability, easy serviceability, fail safe electrical design and a low total cost of ownership (TCO).



High-voltage circuit breaker operating mechanisms type HM – the third generation

Since their introduction, ABB's HMA and HMB operating mechanisms for high-voltage circuit breakers have sold over 110,000 units. Now, the new HMC family – the latest generation – provides even better performance, quality and reliability.

The goal of the HMC development was to improve the characteristics of the existing product – for example, its high level of functionality and compactness as well as ease of adaptation to the circuit breaker – by creating a new product structure and new technology, providing better quality and reliability. Great emphasis was placed on achieving economies of scale and enhanced serviceability.

The design methodology was chosen accordingly:

- Modular design
- Common part strategy
- Standardization of options
- Simplification of assemblies
- Design for excellence (manufacturing, assembly, service, protection against incorrect operation, etc.)

The HMC family is suitable for circuit breakers with ratings of up to 550 kV. Customer requirements can be met flexibly with defined options. In addition, reliability and operational safety are enhanced by a range of improvements – for example, a directly driven pump unit, a direct coupling of control module switching devices as well as an integrated, automatic interlocking pin that can be overrun without damage.

One outstanding innovation is the stroke-dependent resistance of the storage module. This enables the use of helical compression springs in combination with optimized switching characteristics. Furthermore, the most advanced hydraulic components and materials were used – eg, wiper-protected sealing systems are now employed.



Voice control

ABB recently unveiled the world's most advanced voice-activated smart home automation system – ABB-free@home. The innovation allows users to control more than 60 home automation functions in a typical residential smart home environment using voice commands.

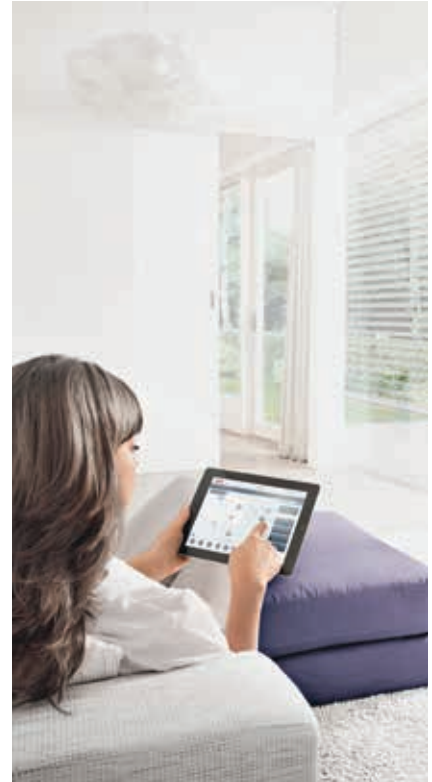
ABB-free@home is a central control system for monitoring and controlling an entire living area: light dimming and switching, timers, blind controls, temperature regulation and door entry. Now, the system can be voice controlled – eg, “Please switch on John’s bedroom lights,” or “John’s room – lights on.” ABB-free@home provides confirmation that a com-

mand has been activated and also responds to questions about the status of its functions.

The dialog processor within the voice control system, which combines voice recognition and a statistical speech model, uses algorithms to recognize the user’s intention and the context. The speech model adapts based on the words programmed in the system. Should the command not be complete enough, the system will ask the user for more information.

The home automation solution is sold under the Busch Jaeger brand in Germany, the Netherlands and Austria and under the ABB brand in all other markets around the world.

For more information on ABB-free@home, see “Intelligent living” in *ABB Review* 3/2015, pp. 48–49.



FlexFeeder helps robots take their pick

The FlexFeeder, in combination with ABB’s Integrated Vision supports the sorting of components, ranging in size from 3 mm to 30 mm, without having to change the feeder each time a different component is fed into the system.

The automation of small-parts assembly demands flexibility, reliability and speed. ABB’s new FlexFeeder can interface with the company’s IRC5 robot controller or any PLC controller. It is available in two variants of different sizes (a larger feeder means more time between refills). The reduced internal gaps and integrated backlight option increase flexibility in feeding small parts.

Both variants are designed to save on installation space and shorten cycle times. Additionally, two or more feeders can work side by side, eliminating the need for separate vision



systems. Driven by pneumatic cylinders, the FlexFeeder takes parts from an unordered bulk supply and dispenses them in small quantities onto the flat picking surface in the field of view of the robot’s vision system. Sensors detect when the tank needs to be refilled. The tank can be purged without power

and changing parts can be done easily and safely. Ground and rack mounting methods simplify installation of the FlexFeeder. Handles make moving and lifting these units much easier. The GUI makes it possible to test the FlexFeeder with one click and to monitor the production status.

Motors that know when it is time for service

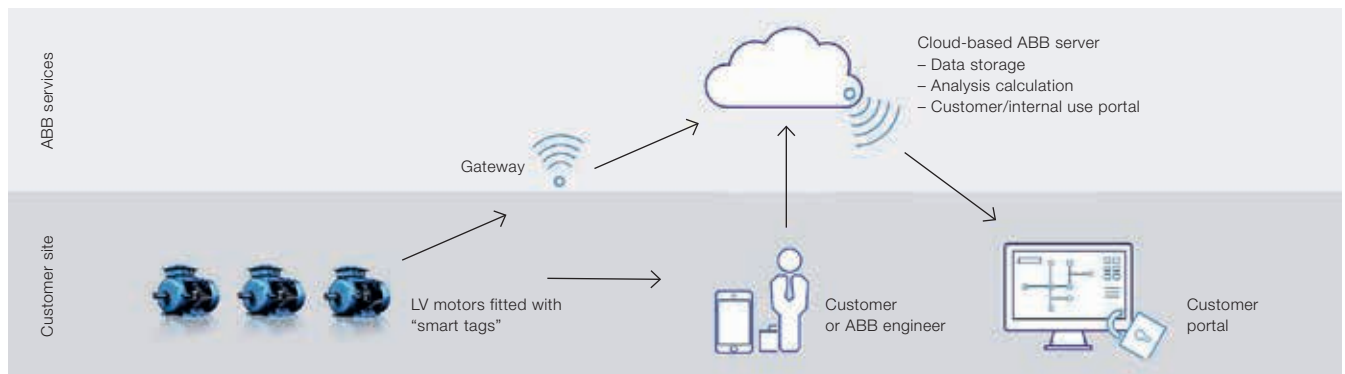
A new and easy-to-use remote monitoring functionality will soon be helping operators save money through improved maintenance planning and by tackling unplanned stops. Smart sensor tags can monitor key parameters and so identify “problem” equipment, highlighting motors that need to be serviced or even replaced. The tool is currently at an advanced stage of development.

Smart tags with sensors will be factory fitted on selected ranges of ABB low-voltage (LV) motors. The tags can also be retrofitted onto other motors. The motors can then communicate wirelessly to the Internet through a smartphone or a gateway. Key operating parameters that are regularly and accurately monitored include:

- Operating information
- Energy consumption (within 10 percent)
- Overloading
- Operating hours and starts
- Motor body vibration and temperature
- Condition related information
- Rotor winding health
- Internal misalignment
- Bearing condition
- Cooling health

The operator will be able to access this data using a smartphone app. The service will support users in identifying potential issues and planning their maintenance accordingly, permitting a reduction in overall maintenance costs and enabling the plant to reduce or even eliminate unplanned stops.

There are also opportunities to optimize a motors’ energy consumption: By combining data on the energy consumption levels of individual motors with plant operating information, it will be possible to formulate better loading strategies aimed at cutting overall energy costs.



World’s first magnet-free IE5 motor for fixed-speed applications

During the present decade, the minimum efficiency for low voltage motors in most regions of the world will be harmonized to a higher level called IE3 (as defined by IEC 60034-30). IE3 is considered to be the maximum practical efficiency level for induction motors. With motor efficiency now harmonized, focus is turning to machines. Machine manufacturers must face two main questions: How can they further leverage energy efficiency for the entire machine, and how will

they seek to differentiate themselves from their competitors when it comes to energy efficiency?

Over the last five years, efforts to overcome the practical limits of induction motor technology made rare-earth permanent-magnet motors more and more popular. There are however cost and sustainability issues related to these materials. ABB is seeking to offer sustainable and cost-efficient high-efficiency motor alternatives for both variable-speed and fixed-speed applications.

Enter SynRM (synchronous reluctance motor) technology. SynRM is available either totally without magnets or with sustainable ferrite magnets. The latest addition to SynRM family is the first magnet-free IE5 motor with line-start capability: DOLSynRM. A 1.5 kW IE5



DOLSynRM motor was presented at EEMODS in Helsinki, in September 2015 and attracted much attention. Sustainable and cost-efficient ultrahigh efficiency motors have become reality! Now it is up to machine manufacturers to take advantage of them. DOLSynRM showcases how ABB is helping its customers maintain their competitive edge while taking responsibility for the future.

Smartphone apps drive data

Drive operators need to access information about their equipment in order to monitor, control and commission it. Above all, this should be possible in an intuitive manner. What better way to achieve this than using a smartphone? ABB has launched two apps for drive operators: Drivebase and Drivetune.

Drivebase is an app for keeping track of drives. It can identify a drive using a QR code and use this to provide fault analysis, service recommendations, reporting on service actions, easy access to product manuals and a search function for ABB contacts. It can also be used to

register a drive to obtain additional warranties.

Drivebase helps operators track their installed base of drives, providing rapid support and easy access to ABB's services. The app can be downloaded for free from Apple's App Store, Google Play and the Windows Store.

Drivetune is an advanced mobile app for monitoring and controlling drives. It allows users to see the status of their drives and to easily perform drive commissioning via an intuitive interface. The app connects to the drive with Bluetooth, enabling data exchange in both directions.

Drivetune is free and available in Google Play. An iOS version will be released in the near future.



Reaction to sunlight

Optimized use of locally generated solar power is one of the drivers inspiring new generation photovoltaic (PV) systems. Overcoming the misalignment between the daily solar power profile and household demand is one of the challenges that must be addressed for new solutions to emerge that meet customer needs, be they the household user or the grid manager. ABB's REACT has been created with the aim of offering customers the optimum trade-off between the cost of the storage solution and the size of the PV array.

REACT (Renewable Energy Accumulator and Conversion Technology) is made of a grid-tied PV inverter up to 5kW fed from a DC link where a bidirectional battery charger and the MPPTs (maximum power point trackers), connected to the PV array, are attached. Its integrated DC link architecture has the best return on

investment for new installations, but it can also be used to retrofit existing PV plants as an AC link battery charger, simply by not connecting the PV array to its input. The energy storage component of REACT is made of lithium ion batteries with a modular architecture that allows the system to expand from

its native 2kWh up to 6kWh. A simple, but effective onboard load management system allow interaction with selected loads/appliances, boosting the energy independency of the household up to 60 percent with a basic system configuration.



A sea of savings with Azipod D

ABB's gearless Azipod propulsion system already sees widespread application on cruise vessels, icebreakers, and offshore accommodation ships. The newest member of the Azipod family, Azipod D, expands the range by specifically addressing shipping segments such as offshore drilling, construction and support vessels and ferries. These applications require high maneuverability (such as dynamic positioning mode) as well as reliability.

ABB's Azipod is a streamlined steerable pod used to propel and steer ships. The pod's propeller is driven by an electric propulsion system con-

tained in the pod. By orienting the pod flexibly, ships can benefit from high maneuverability.

The latest addition to the Azipod family, Azipod D, is raising profitability of vessels by cutting both maintenance costs and fuel consumption. Further benefits include superior maneuverability, competitive investment cost, ease of servicing and maintenance, and a significant performance increase compared with mechanical thrusters.

Azipod D offers designers and builders of ships greater flexibility by accommodating a wide range of hull shapes and propeller sizes, as well as simplicity of installation. The Azipod D requires up to 25 percent less installed power, in part due to its new hybrid cooling that increases the performance of the electric motor by up to 45 percent.



According to Clarkson's Research, the number of vessels with electric propulsion has been growing at a pace of 12 percent globally per year over the last decade, three times faster than the world's fleet.

Integration no longer by parts

The sheer number of intelligent devices performing measurements or actuation tasks in process plants has long represented a challenge for plant operators. These devices typically come from different vendors and communicate through different protocols. Various standards are available for drivers to integrate them into maintenance tools or control systems. Unfortunately each standard is only optimized for a subset of typical tasks in a plant and exposes compatibility and interoperability issues. ABB has taken a leading role in an industry consortium that developed a new single standard – FDI, or Field Device Integration – combining all benefits of the existing ones and supporting unmatched interoperability.

Furthermore, ABB looked beyond the actual technology and ran a study identifying what additional concerns



users have when working with process instruments. Based on this, the company created a new device management tool designed to support both the technician on the plant floor and the maintenance manager in the office by focusing on the essential information and functions of devices. The new tool bridges the classical split between PC-based tools featuring rich graphics and custom-designed hardware tools used on the plant floor featuring limited functionality and restricted graphical user interfaces.

The new software is ready for the new generation of mobile computing equipment designed in ruggedized format and thus suitable for environments with explosion hazards, eg, in chemical or oil and gas plants.

The combination of an advanced integration standard and modern software design is set to open a new area of instrument management in process plants.