IEC e-tech

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Energy harvesting and storage

The focus of issue 05/2014 of IEC *e-tech* is on energy harvesting and storage. Storing energy for later use is not only a must in view of the large scale integration of renewable sources such as wind or photovoltaics but it also helps optimize how and when we are able to use electric power.

Better energy use and storage

Making more with less and stocking energy for later use is the key to more sustainable energy generation

Claire Marchand
Managing Editor *e-tech*

The focus of issue 05/2014 of IEC *e-tech* is on energy harvesting and storage.

Making the most of energy

Energy consumption is increasing at a staggering pace not just in the developed world but in the developing too. Each one of us owns a multitude of gadgets that use electricity, are always on and require constant recharging.

Cities, public services, manufacturing, transportation, agriculture, water and waste management all increasingly rely on electric power. And what we take for granted, others want to have too. While the technologies for energy harvesting and storage are over a century old, they are now getting increased attention and a lot of investment to improve performance and extend the range of applications.

Storing energy for later use is not only a must in view of the large scale integration of renewable sources such as wind or photovoltaics but it also helps optimize how and when we are able to use electric power.

There is a proliferation of technologies that are used to store energy. There is also an increasing number of innovative ways in which energy is now captured that would otherwise be lost. These innovations will make it easier to replace batteries for example in implanted devices or in remote locations. Trends and topics highlighted in this issue include supercapacitors, piezoelectrics, an overview of energy storage technologies and how energy is harvested in a multitude of environments making the most of our energy today and tomorrow.

Energy consumption is increasing rapidly around the world

New technologies are improving energy harvest and storage

Energy harvesting getting bigger

Energy harvesting is increasingly used to power large systems too

Pavegen tiles harvest energy from commuters' footsteps (Photo: Pavegen)

Morand Fachot

Interest in energy harvesting, the process associated with the collection of low-grade energy from sources such as ambient or waste heat, human power, solar, thermal and kinetic energy, and their conversion into electrical energy, is gaining momentum. Viewed initially mainly as a convenient way of powering sensors, small wireless electronic devices and low-power systems, it is also opening up opportunities for use in larger applications. The more so when it is used in connection with certain types of energy storage systems.

Cutting the cord – less batteries please!

Tapping energy from low-grade sources is seen as an attractive solution for powering the growing number of electronic products and devices that operate independently from power networks or without batteries.

Energy harvesting, also known as energy scavenging, is already widely used for powering sensors and actuators, such as those found in certain types of MEMS (Micro-Electro-Mechanical Systems), which are increasingly deployed in sectors such as automotive and medical. International Standards for MEMS are prepared by IEC TC (Technical Committee) 47: Semiconductor devices, and they are tested by IECQ (IEC Quality Assessment System for Electronic Components) testing and certification.

Energy harvesting is useful for devices that do not require a lot of power and when changing batteries may present challenges, such as when they are installed in remote locations, or risks. This is the case in the medical field where energy-harvesting devices that can convert the movement of body parts such as the heart, lungs and diaphragm into energy could be used to power implantable devices – for instance, pacemakers. Research has been ongoing into these devices as well as into the piezoelectric materials that could be used in them. A self-powered cardiac pacemaker using a piezoelectric nanogenerator was demonstrated on a rat in June 2014.

Techniques to harvest energy for other medical devices are also being developed. One example is using jaw movements to power hearing aids, which avoids having to replace internal batteries. New energy harvesting processes, many of them highly ingenious, are being introduced all the time. Some have an entertainment value but may still lead to the development of useful applications. Many others pave the way for the development of more energy-efficient systems. Many IEC TCs develop standards applicable to energy harvesting applications.

The power of play

Some games or forms of entertainment that entail physical activity can include an element of energy harvesting potential, which can be used for various small applications and even pave the way to large-scale ones.

A small company, Uncharted Play, launched the production of two play devices that can convert kinetic energy to power a small LED light or to charge a mobile phone: Soccket, a football, and Pulse, a skipping rope. Both devices are designed for people who live in places without reliable access to electricity, or who have to rely on generators.

Nightclubs use a considerable quantity of energy for lighting, sound systems and more. Dutch company Energy Floors started producing the first piezoelectric energy-generating dance floor in 2008. The floor flexes slightly when stepped on, creating movement which is then transformed into electrical power by a small internal generator. The electricity produced can be used to power screens, sound systems, lights and more.

Energy-generating floors are now also commonly used by exhibitors and museums, allowing them to create interactive environments and experiences for the public and to convey their commercial or educational message.

International Standards for piezoelectric materials and devices are developed by IEC TC 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

Revolving door harvest energy from customers in Natuurcafé Laporte in the Netherlands

Harnessing people's power

Moving on from entertainment and play, energy harvesting systems are also being implemented in larger schemes, in particular in places that see great numbers of people moving and walking through every day.

Energy harvesting pavements have been installed in some heavy pedestrian traffic locations, such as train stations or office buildings, for powering energy-efficient lights or other systems.

Other systems that harness kinetic energy are being installed or tested. They include a revolving door in one Dutch café. The door is equipped with a small generator that recovers the "muscle" energy of customers entering or leaving the place, converts it into electricity and stores it in supercapacitors. It is then used to power the café's LED lights and provides up to 4 600 kWh of energy savings in a year. IEC TC 40: Capacitors and resistors for electronic equipment, develop International Standards for supercapacitors.

A similar principle has led to the development of energy harvesting turnstiles.

A system to harness another form of human energy, body heat, has been installed in Stockholm's Central Station to collect the excess body heat of some 250 000 passengers who pass through the station every day. This heat is collected and used in heat exchangers to produce hot water, which in turn is pumped into the heating system of a nearby building, cutting its energy needs by some 25%.

Going up a gear for extra power

Energy harvesting is often perceived as being applicable mainly to small applications or to larger ones that rely on the collection and conversion of small amounts of mechanical or thermal energy from large numbers of players.

However, energy harvesting is increasingly finding new applications in demanding energy-intensive sectors such as transport, in particular when associated with innovative or improved storage systems.

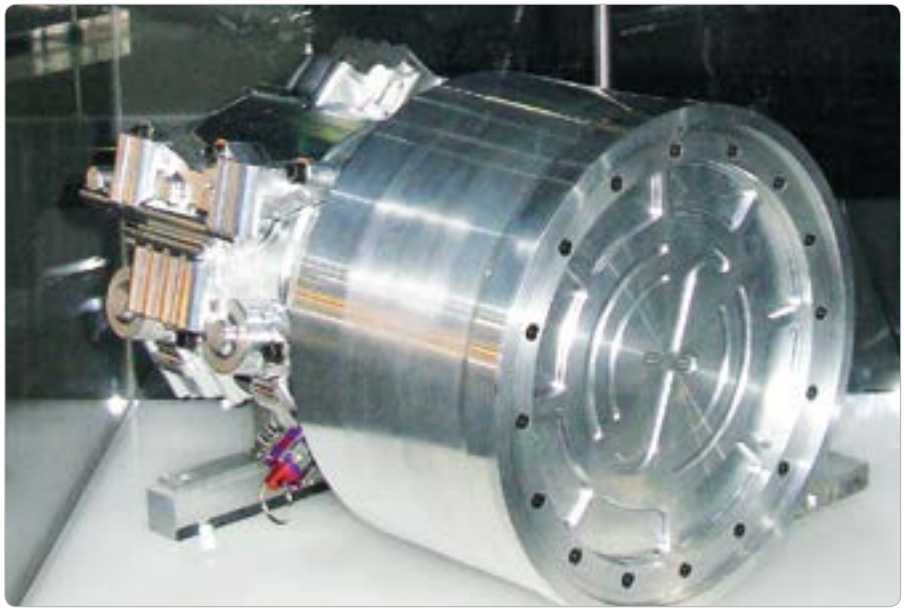
A striking example of this was demonstrated by this year's gruelling 24-hour Le Mans car race in France. Three cars from different manufacturers, which included the winner, the runner-up, and a third car that was in second place before having to abandon the race shortly before its end, were all four-wheel drive hybrid cars that used energy-harvesting systems and different forms of energy storage.

The winning car had a regenerative braking system capability that recovered the moving car's kinetic energy under braking and stored it in a flywheel energy storage system on the front axle. The recovered energy was then used in acceleration phases to provide an additional boost.

The car that came second was fitted with a motor-generator boost system on the front axle. This recovered kinetic energy under deceleration and transferred it for storage in a bank of ultracapacitors. During acceleration, the stored energy delivered a power boost at each axle as required.

The third of the cars, the one forced to retire, also stored energy recovered during the deceleration phases. This one used a lithium-ion battery pack which provided additional boost during acceleration. IEC TC 21: Secondary cells and batteries, prepares International Standards for lithium-ion batteries.

The fact that regenerative charge braking can be used to convert



Flybrid high-speed flywheel installed on motor vehicles (Photo: Flybrid Automotive Ltd)

kinetic energy under such punishing conditions, storing it in different systems – flywheel, ultracapacitors and li-ion batteries – shows that energy harvesting has a future way beyond small-scale applications, in more demanding energy-intensive operations.

Car racing is often a means of introducing technologies that eventually find their way into private vehicles, so these advances will not remain confined to the motor sports world. A leading car manufacturer has recently tested a flywheel system on the rear axle of a front-wheel drive passenger car to determine the potential for fuel savings. Initial results show a performance boost of 80 hp with improved fuel economy of up to 25%.

Flywheels are a form of mechanical storage system that contains components such as coils, motor and generators. IEC TC 2: Rotating machines, prepares International Standards for motors and generators. IEC TC 55: Winding wires, develops International Standards for wires used in coils.

The urban public transport sector in particular offers a great potential for energy harvesting. Regenerative charge braking and energy harvesting shock absorbers are being fitted to buses to charge batteries and supercapacitors for providing extra power. Data published by research company IDTechEx indicates that over 20 000 supercapacitor-based hybrid buses are in use worldwide. This is a huge global market that will make a major contribution to a more energy-efficient transport sector.

In most hybrid buses, even in existing hybrid Formula 1 cars and hybrid concept cars, supercapacitors with less energy storage can replace Li-ion batteries, improving performance, reliability and life, according to Dr Peter Harrop, chairman of research firm IDTechEx.

Supercapacitors charge energy storage

Supercapacitors open up a raft of opportunities for energy storage and delivery

David Appleyard

Electricity storage is currently one of the prime areas for research and development within the energy and automotive sectors. With their high power density and suitability for short duration or pulse events, there is clear potential for super or ultracapacitors to play a significant role in these markets. Demand for the next generation of capacitors could explode in a flash.

Large storage capacity

To witness an electrical storm – one of nature's more spectacular shows – is to witness first hand both the phenomenon of capacitance in action and its power. Capacitance is the ability of a material or device to store an electrical charge and, as lightning strikes show clearly, these types of system are capable of storing significant quantities of power – and delivering it extremely rapidly.

Maxwell K2 2,85 V, 3400 F ultracapacitor cell (Photo: Maxwell Technologies Inc)

As is often the case, humanity's efforts are way behind those of Mother Nature, but the property of capacitance has nonetheless been exploited for use in numerous applications over the years. However, only within the last 30 years or so have capacitors moved on from being limited predominantly to basic parallel plate types with either a dry or wet electrolyte separating the charge-carrying elements. Capacitance is measured in F (farads), the SI (international system of units) derived unit of electrical capacitance standardized by the IEC and named after the scientist Michael Faraday. These types of capacitor have a low storage capacity typically measured in pico, nano or micro farads. Applications include signal and power filtering and buffering.

In the late 1950s, General Electric began experimenting with double-layer capacitors, which led to the development of a primitive supercapacitor. With no commercial applications, the breakthrough was not vigorously pursued until advances in materials sciences and manufacturing improved performance and reduced costs to enable such devices to begin emerging on a commercial basis in the 1970s.

Rated in farads, supercapacitors are capable of storing tens of thousands of times more power than their conventional electrolytic cousins.

Materials advances, better performance

Although capacitors store electrical energy, this energy is stored electrostatically on the surface of the material rather than chemically as is the case with batteries. The key to capacitor performance is therefore a large surface area which is available to carry charge. Uniquely in supercapacitors, the electrostatic charge is stored in an electrochemical double layer and that is far thinner than can be achieved with any dielectric.

Ioxus ultracapacitor modules are used in wind turbines pitch control, automotive subsystems, backup power/UPS, etc. (Photo: Ioxus Inc)

Capacitance is therefore boosted by both this and the exceptional area offered by advanced carbons.

Supercapacitors – most commonly EDLCs (Electrochemical Double Layer Capacitors) – are based on high performance materials that allow a very high power density (W/kg). EDLCs feature electrodes comprised of multiple stacked layers of nonreactive highly porous carbon and thus have an enormous surface area. Graphene – a layer of carbon one atom thick – in particular is attracting considerable attention in this field and is expected to appear in commercially available products within the next decade. Researchers are also investigating carbon aerogels and nano tubes for use in supercapacitors.

An example of these materials is a family of ultracapacitors revealed in June 2012 with devices offering from 2,47 to 12,53 kW. According to the manufacturer, the cells delivered a 300% increase in power and 200% increase in energy in comparison with commercially available products as a result of their carbide-derived carbon material. This allowed raising their energy density to 10 Wh/kg and their power density to more than 40 kW/kg.

In June 2014, another manufacturer revealed the latest addition to its series of ultracapacitors a new 2,85 V, 3400 F ultracapacitor in an industry-standard 60 mm cylindrical form. Supercapacitors exhibit very favourable characteristics in terms of power density and also have the ability to be charged and discharged countless times without any degradation in performance. This is in stark contrast to chemical batteries which have a defined life span in terms of cycling.

In addition, supercapacitors can be charged and discharged in a matter of seconds and function well over a broad temperature range. They are also resistant to shock and vibration. However, they have a low energy density (ranging from around 1 Wh/kg to 30 Wh/kg), particularly when compared with Li-ion (lithium-ion) batteries, which have about five times the energy density. Another disadvantage in comparison with chemical batteries is the discharge curve, which sees the output voltage drop as the capacitor is discharged.

Although costs are falling rapidly, materials costs for supercapacitors are still relatively high due to the increased difficulty in creating advanced materials like graphene. Nonetheless, their characteristics make supercapacitors ideal for applications requiring frequent charge and discharge cycles at high power but of short duration.

A growing world of applications

Inevitably there are any number of applications that may benefit from the use of supercapacitors, but there are a number which stand out, particularly within the transport sector. For example, vehicle braking occurs over timescales measured in seconds – a duration not compatible with regenerative systems using chemical batteries which can take hours to charge. In contrast supercapacitors can capture and store energy produced by regenerative braking, before releasing it quickly for the maximum power demands of acceleration. As a result they are increasingly being

Hybrid bus equipped with ultracapacitors being recharged in Shanghai

found in cars, trams and buses, for example in start-stop technology for automobiles. A number of carmakers already offer vehicles with this feature. Some estimates suggest that in this role supercapacitors could deliver energy savings of perhaps 15%–25%.

Other applications are found in cordless power tools, computers and consumer electronics. Suitable examples include delivering the power pulses required to focus camera lenses or sending bursts of information over wireless systems.

Supercapacitors are also emerging as a direct replacement for batteries in heavy goods vehicles where their low temperature performance – which far exceeds that of lead-acid batteries – is seeing them used for cold weather starting. Another example comes from the renewable energy sector where supercapacitors can provide energy storage for renewable energy installations and increased grid stability. They are also found in wind turbine blade pitch systems, particularly offshore where their long life and reliability is a key advantage over battery technologies.

Market development

While at face value it may appear that supercapacitors are competing head-to-head with batteries, in particular with Li-ion technology, a more likely scenario is a complementary development. Under this scenario in transport for example batteries would deliver durable power for range while supercapacitors would provide high power for acceleration. This reduces the requirement for batteries, thereby cutting weight – a critical factor in vehicle performance. IEC TC 40: Capacitors and resistors for electronic equipment, has already published International Standards for EDLCs, and has now earmarked these and hybrid EDLCs, which combine a capacitor and a battery, as being in need of appropriate standardization.
Dr Peter Harrop, chairman of research firm IDTechEx, argues that supercapacitors represent a rapidly emerging multi-billion dollar market. The company notes that there are around 200 major manufacturers of electric motors for traction and more than 100 battery suppliers for this market. However, this compares with around 50 or so major supercapacitor manufacturers. “Supercapacitors are improving much faster than are batteries,” Harrop tells *e-tech*. He explains that while the cost of lithium batteries has fallen by around 40% over the last 10 years, the cost of supercapacitors has fallen to less than a 100th of their initial cost over the same period.

Harrop acknowledges that the impact of supercapacitors on battery sales is still limited but that the gap in sales is narrowing, albeit from a very small base. He notes that the largest reported supercapacitor transaction has increased by a factor of more than 10 within the last year.

In particular, Harrop points to the potential emergence of supercapacitors integrated into a variety of structures – anything from electronics cases to buildings – or even into clothes. “The buzz word is structural electronics, structural supercapacitors,” he says, adding: “There could be standards there for structural supercapacitors that are being developed in the lab.” Ultimately, supercapacitors offer environmentally-friendly energy conservation. In a complementary role with other energy storage technologies, the supercapacitor is charging ahead.

Piezoelectrics power onwards

Piezoelectric materials and devices are used in many applications

David Appleyard

Although the first practical piezoelectric devices emerged little more than three decades ago they are becoming increasingly commonplace and can now be found in a diverse array of devices and applications. With new materials and designs constantly emerging, developments in piezoelectric technology focus not only on achieving more desirable operational characteristics but on improving environmental performance too.

Not that recent

Although the first practical piezoelectric devices emerged little more than three decades ago they are becoming increasingly commonplace and can now be found in a diverse array of devices and applications. With new materials and designs constantly

Piezoelectric actuators are used in optronics, scientific instruments and aerospace products (Photo: Cedrat Technologies)

emerging, developments in piezoelectric technology focus not only on achieving more desirable operational characteristics but on improving environmental performance too.

First demonstrated by Pierre and Jacques Curie in the latter half of the 19th century, the piezoelectric effect is a phenomenon in which certain crystalline materials generate an electrical charge when exposed to mechanical stress. Inversely, these types of materials exhibit dimensional change when presented with an electrical field.

This effect is linear: the greater the deformation, the higher the charge developed and vice versa. This means that piezoelectric materials are ideally suited to function as electromechanical transducers, such as those found in medical and industrial applications of ultrasonics (see article on ultrasonics in April 2014 *e-tech*). Today they are typically found in sensor systems and, increasingly, in energy harvesting applications (see article on energy harvesting in this *e-tech*).

Naturally occurring piezoelectric materials include quartz and tourmaline but manufactured ceramic materials such as barium titanate and the more commonly used lead zirconate titanates (PZT) are also produced.

These ceramics, so-called ferroelectric materials, can be rendered piezoelectric through a process of polarization by applying a strong electrical charge to the material, usually at an elevated temperature (2-3 kV/mm at 80°C–140°C).

As with many ceramic materials, piezoelectric ceramics are hard, chemically inert and can be formed into almost any shape required. Mechanically they are similar to commonly found insulators and they are also impervious to atmospheric conditions.

Production of piezoelectric ceramics typically begins with a powder consisting of oxides of lead, titanium and zinc. This powder is then compacted into a mould before sintering at temperatures of 1 000°C – 1 300°C, which allows the material to develop its polycrystalline structure.

After finishing and polarization, characteristics such as capacitance and resonant frequency are determined by the dimensions of the product and the material used.

An alternative production method uses a process akin to printing – screen or pad – to deposit a layer of piezoelectric material on a substrate of the desired shape. According to its proponents, this process supports further miniaturization of piezoelectric devices, as well as enabling focused transducers to be developed using curved substrates.

Piezoelectric vibration LTD sensor used in vehicle alarms and more (Photo: MEAS, Measurement Specialties)

Tri-axial piezoelectric accelerometer (Photo: Meggit Sensing Systems)

Applications for piezoelectric materials

Piezoelectric materials are often employed in applications requiring measurement. Frequently these involve basic physical tenets such as force, acceleration or pressure. Piezoelectric transducers are ideal for converting such qualities into electrical signals.

Given their suitability as electromechanical transducers, it's no surprise to see such materials in numerous sensor applications such as those found in the ultrasonic measurement of distance in air – as exemplified by aids in your car that help you to reverse – but also in materials-testing equipment, in accelerometers and pressure sensors, and in medical equipment. They are also employed in spark generators, for example those used in an electronic ignition cigarette lighter.

There are two main types of sensor: axial and bending. In axial sensors the force is applied parallel to the direction of polarization (known as d33 mode), while in bending sensors the force is applied perpendicular to the polarization (so-called d31 mode).

A number of other applications require displacements beyond what is possible with transducers operating in d33 or d31 mode. In such cases a flexure or cantilever element such as a bimorph – two bonded strips of PZT – can be used.

Piezoelectric ceramics fall into two broad categories: hard and soft. So-called 'hard' ceramics are capable of handling high levels of electrical excitation and mechanical stress and are suitable for use in high voltage or high power applications. Soft ceramics display high sensitivity and permittivity (i.e. level of resistance encountered when forming an electric field in the material) but are vulnerable when heated beyond their operating range under high power conditions. These soft ceramics are typically found in low power applications such as sensors, receivers and low power generators.

Exploiting the inverse piezoelectric effect these materials are also found in atomizers, cleaning equipment and as low-power actuators. Piezoelectric motors are unaffected by energy efficiency losses that limit the miniaturization of electromagnetic motors and do not produce electromagnetic noise. Piezoelectric actuators may therefore be employed in controlling hydraulic valves or acting as small-volume pumps.

Technology trends

One key area of piezoelectric materials development is focused on new applications and new materials to improve sensitivity, durability and operational performance. For example, a UK manufacturer launched a new range of air in-line and occlusion sensors for the medical sector in September last year.

Capable of delivering non-invasive air bubble detection and measuring pressure changes in tubes leading into the body, the devices provide a precise means of monitoring safety-critical events in medical products such as infusion pumps, dialysis equipment and other fluid-handling applications.

The company says the technology has been developed in response to the increasingly large variations in tube sizes and materials used in the medical market for drug delivery and fluid management.

The development followed the March 2013 launch of PZT5K1 a new high density and low porosity piezoelectric material by the company suitable for applications in medical instrumentation and energy harvesting, among others.

Some of the new materials that are being considered for piezoelectric ceramics are ones that do not contain lead, which present problems on account of its toxicity as well as potential challenges associated with its final disposal. A manufacturer explains that this advance is likely to occur within the decade, but warns that the performance of lead-free materials is "not yet anywhere near where it needs to be in terms of sensitivity".

Setting standards and upcoming challenges

Within the IEC, most International Standards for piezoelectric technology, with the exception of those for piezoelectric transducers, which are prepared by TC 29: Electroacoustics, and TC 87: Ultrasonics, are developed by TC 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

It is clear that piezoelectric materials are becoming more diverse, more sophisticated and more effective. International Standards will evolve to ensure further advances in the piezoelectric domain.

Storage solutions central to renewables

The future of renewable energies will rest on the right mix of storage

Upper and lower basin of Limberg II pumped storage plant, Austria (Photo: Voith)

Morand Fachot

As many countries try to increase the share of REs (renewable energies) in their portfolio for producing electricity, a major issue facing utilities is that of EES (electrical energy storage). Generally, electricity is consumed as it is produced; however, as the input from renewable sources is mostly intermittent and not always available when needed, EES is vital for enabling their integration in the overall energy mix. Different technologies are available or are under development to improve storage capacities for RE sources.

Balancing needs

To balance increasing levels of intermittent RE generation from wind and solar systems, EES solutions are needed that use and store energy efficiently and help improve grid stability and flexibility.

The IEC strongly supports EES. The IEC MSB (Market Strategy Board) has published two White Papers, the first on EES, the second analysing the role of large-capacity EES systems that integrate large-capacity RE sources. Both White Papers stress the crucial importance of EES in future installations. There are a number of utility-scale storage solutions that can be classified loosely into three categories: mechanical, electrochemical and electrical.

Old is not out

EES is not recent: some storage solutions have been around for well over a century.

Pumped-storage hydropower was first used in Italy and Switzerland in the 1890s. It currently represents the largest and most flexible EES solution and is experiencing significant growth. Energy generated at low-demand periods is stored by pumping water into a higher reservoir. It can then be released at peak time to produce electricity.

Compressed air energy systems predate electricity and were initially installed in the late 19th century to deliver [compressed air] power to factories and homes. CAES (compressed air energy storage) was first used for utility-scale electricity storage in the late 1970s. Its use is similar to that of pumped storage. Air is compressed and stored in an underground reservoir during periods of excess power. It is then released, heated and expanded in an expansion turbine driving a generator to produce electricity at peak time.

Solid-state batteries, which convert stored chemical energy into electrical energy, are also a well-established storage solution. Modern battery systems have been able to benefit from advances in technology and materials to improve the capabilities of such systems.

But newer systems are in too

Flow batteries are a type of rechargeable battery that converts chemical energy into electricity; in some respects they are similar to fuel cells. In flow batteries, electroactive chemical components dissolved in liquids are separated by a membrane through which ions are exchanged to provide electrical current.

The principle of flywheels has been known for a long time; the devices were used in mechanical systems long before electricity was introduced. In EES, flywheels store electrical energy in the form of kinetic energy in a low-friction spinning mass (best operated in a vacuum) that is driven by a motor. When electricity is needed, the spinning mass drives a device similar to a turbine to produce electricity.

Thermal energy storage is used, notably in thermal solar plants, for storing excess energy during peak insolation periods in the form of molten salts or other materials. The stored heat can be used at times when sunlight is not available. Alternatively, excess electricity can be used during periods of low demand (night) to produce ice. This can be incorporated in buildings' cooling systems to reduce demand for energy during the day.

Chemical storage, in the form of hydrogen or SNG (synthetic natural gas) produced from excess electricity, is another form of storage. Both hydrogen and SNG can subsequently be used to produce electricity at peak time or for other applications such as transport.

Advantages and drawbacks

Each EES system presents characteristics that make it more or less suitable for different applications.

350 kW/2,5MWh LAES (liquid air energy storage) pilot plant in Slough, UK (Photo: Highview Enterprises Ltd)

Pumping water: Pumped-storage hydropower currently accounts for more than 99% of installed storage capacity for electrical energy worldwide: around 127 GW (gigawatts), according to the EPRI (Electric Power Research Institute – the research arm of America's power utilities) and Germany's Fraunhofer Institute. However, pumped storage can only be installed in places where water can be pumped into a higher reservoir. A new technology being developed, Gravity Power Module, uses similar principles, but as it stores water in underground shafts it is not constrained by the same specific geological features. Its developers claim that it has a small footprint and doesn't require the same high levels of investment or engineering work, making it suitable for application in many more locations.

Compressing air: In the only two CAES installations currently operating that use the so-called diabatic method, air is heated naturally when being compressed from atmospheric pressure to storage pressure. In these two installations this heat is mainly lost before air is pumped into the underground caverns. Another CAES system uses the so-called adiabatic method, which recovers the heat of compression. While this is much more efficient, it is still at the R&D (research and development) stage.

In another related process, called LAES, (liquid air energy storage) offpeak or excess electricity is used to power an air liquefier, which produces liquid air that is stored in a tank(s) at low pressure. Power is recovered when needed as the liquid air is pumped to high pressure, evaporated and heated. The high pressure gas drives a turbine to generate electricity.

Turning the wheel: Flywheels can capture energy from intermittent RE sources and deliver uninterrupted power to the grid. They can respond instantly to demand. The most efficient flywheels are made of carbon, can rotate at a higher speed than those made of steel, are low maintenance and have a long life. Flywheels are particularly well suited to a number of applications including power quality and reliability and frequency response. They are also used in hybrid sports cars and are being tested by a number of vehicle manufacturers (see article on energy harvesting in this *e-tech*)

Getting the right chemistry and right temperature: Secondary (rechargeable) batteries have been around for well over a century. They rely on different chemical bases. Beside the lead-acid type, the main types used for storage from RE sources are nickel-based NiCd and NiMH, as well as Li-ion and NaS (sodium sulphur). New chemistries and production methods have greatly improved the efficiency of secondary batteries. The main advantage of flow batteries, another electrochemical storage system, is that they can be recharged almost instantaneously by replacing the electrolyte liquid, which can subsequently be recovered and re-energized.

Thermal storage of the molten salt type is well suited to use in thermal solar plants and allows storage of large amounts of energy that can then be recovered to generate electricity as required.

Standards matter

IEC International Standards for certain mature EES systems, such as pumped hydro (developed by TC (Technical Committee) 4: Hydraulic turbines) or rechargeable batteries of various types (prepared by TC 21: Secondary cells and batteries) are already in existence. With the need for Standards for EES systems, the IEC created TC 120: EES (Electrical Energy Storage) Systems in 2012. The TC oversees the development of International Standards that address all different types of EES technologies taking a systems-based approach rather than focusing on individual energy storage devices.

EES systems will become essential technologies in achieving RE integration and Smart Grid expansion as well as achieving a more efficient and reliable electricity supply. IEC International Standards will be central to realizing these goals.

Beacon Power 20 MW flywheel frequency regulation plant (Photo: US DOE)

Big data, big future

New ISO/IEC JTC1 study group

Identifying key big data terms and definitions, and scoping out the role of standardization are…

Janice Blondeau

Business, academic, and government leaders broadly agree about the potential of big data to fuel innovation, advance commerce and drive progress. We know that big data could change how we work – by improving operations, allowing faster, more accurate analyses, hence more informed decisions. But what exactly is big data and how does international standardization fit in?

Big data is…

When it comes to defining big data, Wikipedia calls it "any collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications". Fatemeh Khatibloo and Brian Hopkins at Forrester Research describe big data as "a journey that every company must take to close the gap between the data that's available to them, and the business insights they're deriving from that data".

However a lack of consensus on some fundamental aspects is confusing to potential users and holding back progress.

New study group with big data focus

ISO/IEC JTC (Joint Technical Committee) 1: Information technology, has recently created ISO/IEC JTC 1 BD SG (Study Group on Big Data) to scope out the role of standardization in big data and to make recommendations for future standards development.

Specifically it has been tasked with surveying the existing ICT (information and communication technology) landscape for key technologies and relevant standards, models, use cases and scenarios for big data from JTC 1, IEC, ISO and other standards development organizations. It will also identify key big data terms and definitions.

A third work area of the study group is to assess the current status of big data standardization market requirements, identify standards gaps, and propose standardization priorities to serve as a basis for future JTC 1 work.

…two of the activities of new JTC 1 study group

Recommendations will be made to the JTC 1 plenary taking place in November 2014

The challenges ahead

Jim Melton, Chair of ISO/IEC JTC 1 SC 32: Data management and interchange, sees that big data provides many challenges. "Retention and data quality are only two of them, and not necessarily the most difficult. Processing that data, querying it, analysing it and summarizing it are going to be quite difficult. In many environments, simply describing the data – developing metadata for it – will be vitally important and very difficult to do."

"This is a very exciting time to be involved in IT standardization," said Melton. "I truly believe that addressing the problems, challenges and opportunities associated with big data can create a paradigm shift."

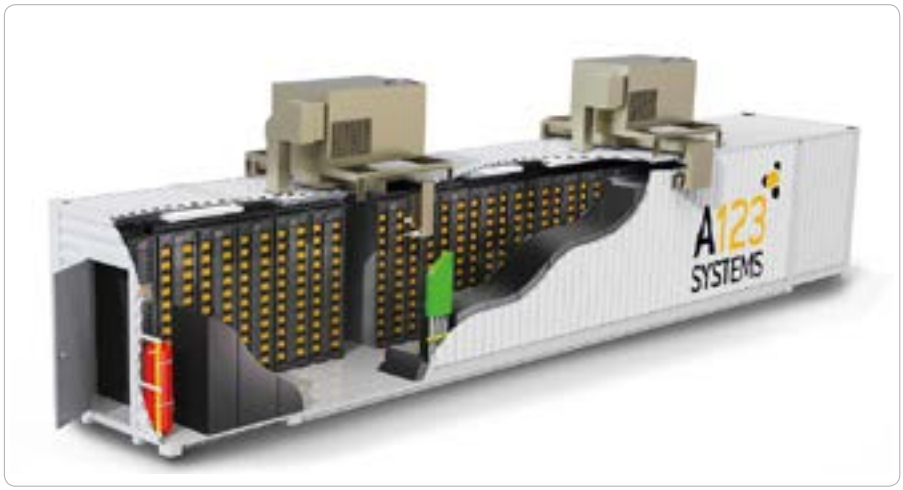
The study group will report with recommendations and other potential deliverables to the 2014 ISO/IEC JTC 1 Plenary which will take place in Abu Dhabi, United Arab Emirates, in November 2014.

Batteries central to future grid storage

Batteries are set to play an increasing significant role in future grid energy storage

Morand Fachot

Electricity is consumed as it is generated, supply must be reliable and demand must always be met. This requires spare capacity that can be ramped up rapidly and, ideally, storage. Utility-scale storage capabilities are still limited mainly to pumped hydro, but this is changing with the emergence of a new generation of advanced batteries that allow for storage on the grid. Standardization work by IEC TC (Technical Committee) 21: Secondary cells and batteries, is central to the future development of large-scale energy storage for the electric distribution network.



A123 systems nanophosphate EXTTM grid storage solution (Photo: A123 systems)

Current storage limitations

The characteristics of electricity generation, distribution and use are very specific. Electricity being consumed as it is produced there must be sufficient supply to meet variations in demand. At times of peak demand extra capacity must be available to respond rapidly. If demand cannot be met, the stability and quality of the power supply suffer and may result in brownouts or worse.

To balance demand and supply additional generation in necessary and a certain amount of storage may also be available, currently mainly in the form of pumped hydro, which makes up the bulk of electricity storage. However significant pumped storage might be, additional EES (electrical energy storage) sources are needed in the future.

The IEC works extensively on developing standards for EES technologies to provide safe and stable energy supply and to integrate electricity from intermittent renewable sources into the overall distribution grid.

Advanced batteries are set to play a major role in the future global EES landscape and in grid management. A May 2014 report from Navigant Research forecasts that the annual energy capacity of advanced batteries for utility-scale energy storage applications will grow at a CAGR of 71% from 2014 through 2023, from 412 MWh in 2014 to more than 51 200 MWh in 2023.

Fresh prospects from the new generation

A new generation of advanced safe, low-cost and efficient enough batteries to allow for storage on the grid has paved the way to the first instances of large-scale energy storage for the electric distribution network. However this introduction is still limited to high-value applications like frequency regulation and demand charge mitigation, according to clean technology markets consulting company Navigant Research. Navigant estimates that global revenue from next-generation advanced batteries, which include Li-ion (lithium ion), sodium metal halide, NaS (sodium sulphur), advanced lead-acid and flow batteries, will grow from USD 182,3 million in 2014 to USD 4,9 billion in 2023.

Finding the right chemistry for the right use

IEC TC 21 lists the key areas of battery standardization as SLI (starting, lighting, ignition) also named “starter” batteries, which supply electric energy to motor vehicles; automobile hybrid/electric vehicle cells; traction batteries; and the stationary batteries of the VRLA (valve-regulated lead-acid) type also known as sealed or maintenance-free batteries.

Beside stationary applications, VRLA batteries are used also in motorcycles and certain types of cars to reduce the risks of acid spilling. Lead-acid batteries are a proven and widespread technology and are still the preferred storage system to assure decentralized electric power in emergencies and in applications such as UPS (uninterruptible power systems).

This 50 kW HBr flow battery system provides up to 100 kWh of energy (Photo: EnStorage Inc)

Latest research in the stationary lead-acid battery market indicates a CAGR (compound annual growth rate) of 6,8% over the 2010-2017 period, with little threat from competing technologies during this period.

Nickel-based batteries, such as NiCd (nickel cadmium), introduced around 1915, and NiMH (nickel metal hydride) in service 80 years later, have a higher power density and a slightly greater energy density than lead-acid batteries. They are used in both stationary applications and in consumer electronics where they are being replaced in many cases by Li-ion and where NiCd batteries are being phased out on environmental ground. NiMH batteries are also extensively used in hybrid vehicles.

Li-ion is the primary chemistry used in batteries for consumer electronics, medical and defence applications, it is also emerging as a leading chemistry in utility-scale applications of batteries on the grid. The main advantage of Li-ion batteries is a very high energy density, but their main drawbacks are cost and safety issues (like overheating) that require constant monitoring.

To prepare International Standards for rechargeable batteries used in RE storage, TC 21 and TC 82: Solar photovoltaic energy systems, set up a JWG (Joint Working Group), JWG 82: Secondary cells and batteries for Renewable Energy Storage.

Let the current flow

TC 21 has broadened its scope to include technology and chemistry for flow batteries, which are starting to be deployed in the market and, as such need international standardization regarding performance, performance tests and safety.

Flow batteries are rechargeable batteries in which electroactive chemical components dissolved in liquids (electrolytes) stored externally in tanks are pumped through a membrane that converts chemical energy into electricity.

To develop standards for flow batteries that cover safety, performances, installation, terminology and other necessary requirements, TC 21 set up JWG 17: Flow battery systems for stationary applications, with IEC TC 105: Fuel cell technologies, as flow batteries and fuel cells share certain characteristics.

TC 21 current approved new work programme includes the development of International Standards for “flow battery systems for stationary applications” that cover general aspects, terminology and definitions, performance general requirement and method of test, and safety requirements.

The first ever grid-connected flow battery storage solution for use with renewables, a 50 kW EnStorage Inc. HBr (hydrogen-bromine) system providing up to 100 KWh of energy, was connected to a test site in southern Israel in April 2014.

A very broad remit

If the development of International Standards for batteries deployed in EES systems for utility-scale applications is currently attracting much interest, the performance and other characteristics of batteries used in a broad range of domains, such as consumer electronics, transport or medical equipment, are also the focus of a lot of attention (see *e-tech* May 2012 article on batteries for mobile devices and applications).

All International Standards for rechargeable cells and batteries, irrespective of type or application, or of size, from the tiniest cell to the largest array of batteries installed in EES systems, are prepared by IEC TC 21. These Standards cover all aspects depending on the battery technology, such as safety installation principles, performance, battery system aspects, dimensions and labelling.

Given the central role batteries play in so many systems and applications, a world without TC 21 standardization work for batteries is no longer conceivable.

8 MW li-ion battery grid storage system in New York State (Photo: AES Corporation)

Tackling cyber security threats

IECEE is developing the necessary strategy and business plan to minimize exposure to these risks

Claire Marchand

The development of automation throughout the 20th century brought enormous changes to the industrial world: some jobs disappeared, others underwent major transformations, new ones were created and, most importantly, the interaction between man and machine was altered forever. The rapid evolution of IT (information technology) in the second part of the 20th century enabled engineers to create increasingly complex control systems that integrated fully between the factory floor and the office environment.

A complex issue

The complexity and sophistication of today's systems and equipment in industrial plants require a specific approach to safety and security. The cyber security issue has been under close scrutiny in recent years. The risk of being subjected to a cyber attack is not to be taken lightly: industrial facilities (food processing, robot assembly), utilities (oil, gas, water, electricity), transport systems to name just some, these industry sectors may be targeted and will pay a dear price if unprotected.

More often than not, the aim of a cyber-attack isn't the complete shutdown of a target's network, but rather a surreptitious intrusion into the network. This may have dire consequences, causing serious damage to the systems and potentially endangering the lives of those operating the installations.

Increased protection

Understanding the cyber environment, protecting industrial control and automation systems, identifying cyber threats and possibly anticipating future development are at stake here.

Systems and equipment in industrial plant are complex and sophisticated

Today's cyber threats are global

Minimizing exposure to cyber risks is the challenge that industry has to tackle. Among the tools at its disposals are standardization and conformity assessment.

Recognizing that the topic is of vital importance to industry, IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components, asked its special WG (Working Group) on Industrial Automation to set up a Task Force to consider the cyber security issues and the potential services the System could offer to tackle them. Apart from cyber security the WG also has the responsibility to deal with functional safety.

IEC International Standards

While it may be challenging to test and certify cyber security, IECEE can already rely on IEC International Standards on automation security that address the issue, notably the IEC 62443 series of standards on Industrial Communication Networks – Network and System Security.

...and Conformity Assessment address the issue

Cyber security was on the agenda of the CMC (Certification Management Committee) during the IECEE annual series of meetings, held in Cairns, Australia in June 2014. Ron Collis, Chairman of the IECEE and Convenor of the PSC (Policy and Strategy Committee) WG on Industrial Automation, updated his colleagues on the work of the WG pertaining to cyber security. Among the decisions made, the CMC approved the development of a business plan and supported the recommendation to continue discussions with other organizations, such as ISA (International Society of Automation) and WIB (Process Automation Users' Association) to evaluate potential cooperation.

IECEE recognizes that the cyber security issue is of vital importance to industry

Close collaboration

To stress the importance of the issue, IEC CAB (Conformity Assessment Board) has also set up WG 17 on cyber security, of which Ron Collis will be Convenor. Members of the IECEE WG on industrial automation may also be involved in the CAB WG 17, but, while collaboration between the two groups is encouraged, the responsibilities of each group will be clearly defined, to avoid any overlap.

For more information on IECEE: www.iecee.org

Global safety and security

IECEx helps minimize risks in the Ex sector

Claire Marchand

Batteries are probably the most common and widespread means of energy storage. From the AA or AAA type you buy at your local supermarket to the highly sophisticated new generation of batteries used in EVs (electric vehicles) or by utilities, there are millions of products on offer.

Explosion-proof torch light used in hazardous locations (Photo: Larson Electronics) issue is of vital importance to industry

Extensive use

Whether off-the-shelf or specially-designed cells, primary or secondary (rechargeable) batteries are all built on the same model: one or more electrochemical cells that convert stored chemical energy into electrical energy.

Lead/acid batteries or alkaline (nickel-cadmium, nickel-metal hybrid or lithium ion) rechargeable batteries are used in all kinds of small devices, such as computers, smart phones, tablets and cameras. Their large-capacity counterparts are commonly used in transport (industrial EVs, buses and trucks) and in UPS (uninterruptible power supply) systems.

Ex environments multiply the risks

These same batteries are used extensively by the Ex (explosive) industry sector. The people working in flammable and potentially explosive conditions depend on battery-powered portable and fixed equipment such as walkie-talkies, lamps, gas detectors and air-monitoring devices.

Battery-powered scoop in a coal mine (Photo: GE)

They may also operate electric forklifts and other industrial EVs within large facilities, plants and mines.

IEC and IECEx tame those risks

While the recharging of batteries, large and small, can be hazardous in itself – hydrogen and oxygen are usually produced inside the battery when charging – the risks are much higher in Ex environments. This is why the batteries themselves, although very similar to their off-the-shelf counterparts – have to be designed and build in compliance with the very strict requirements enunciated in standards and specifications, most notably in IEC International Standards developed by IEC TC (Technical Committee) 31: Equipment for explosive atmospheres. This is valid for small-capacity cells as well as for traction batteries (used in EVs).

Battery-operated devices are submitted to the same constraints. Their design and manufacture must be able to withstand the harshest and most extreme environmental conditions. They have to be well insulated and explosion-proof.

Certification needed

Designing and building batteries and containers in compliance with IEC International Standards is not enough. To ensure that any piece of equipment meets the required criteria, it has to be tested and certified. Products associated with a certificate of conformity can be used safely in hazardous environments.

IECEx, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres, is the only truly international CA (Conformity Assessment) System that provides testing and certification for all Ex equipment and installations as well as certifies the skills and competence of individuals working in hazardous areas.

The IECEx Schemes

IECEx Certified Equipment Scheme
It provides assurance that the strictest safety requirements of IEC International Standards, as referenced in many national or regional compliance programmes, are met, e.g. ATEX.

IECEx Certified Service Facilities Scheme
It assesses and certifies that organizations and workshops that provide Ex equipment selection, design, installation, inspection, maintenance, repair, overhaul and reclamation services to the Ex industry do so respecting the strict requirements of the following IEC International Standards:

- IEC 60079-14, *Explosive atmospheres - Part 14: Electrical installations design, selection and erection*
- IEC 60079-17, *Explosive atmospheres - Part 17: Electrical installations inspection and maintenance*
- IEC 60079-19, *Explosive atmospheres - Part 19: Equipment repair, overhaul and reclamation*

IECEx Scheme for Certification of Personnel Competence (for Explosive Atmospheres)
The IECEx CoPC (Certification of Personnel Competence) provides assurance to those engaging or dealing with IECEx-certified persons that their knowledge and competence have been independently verified.

The System also has the **IECEx Conformity Mark Licensing System** which provides immediate evidence that products bearing the Conformity Mark are covered by an IECEx Certificate of Conformity.

Increased level of security

Manufacturers who rely on IECEx for the testing and certifying of their equipment, who have their staff go through the steps necessary to obtain a Certificate of Personnel Competence, have that additional level of security that makes a real difference. They know that they operate in the best possible conditions and minimize the risks inherent to Ex sector.

United Nations endorsement

With its three Schemes, IECEx covers all aspects of conformity assessment in the Ex field. In addition to equipment and personnel, the System also provides testing and certification for service facilities that repair and overhaul Ex equipment. Its global scope has been reinforced by the endorsement it received from the United Nations through the UNECE (UN Economic Commission for Europe) as the internationally-recognized certification system for promoting the safety of equipment, services and personnel associated with devices, systems and installations used in explosive areas.

Access to certificates anytime, anywhere

IECEx has developed a mobile application for iOS, Android tablets and smartphones, that can be found at the Apple App Store and Google Play. It installs a simplified version of the main IECEx online Certificate System covering Certified Ex Equipment and allows the user to synchronize the Ex Mobile App with the IECEx online Certificate System, as required. The offline mode provides advanced search capability and CoC (Certificates of Conformity) abstracts (simplified details), while the online version gives the full details of CoC.

UNECE published A Common Regulatory Framework for Equipment Used in Environments with an Explosive Atmosphere *in 2011*

For more information on IECEx: www.iecex.com

Renewing ties with a former partner

Russia shows keen interest in IECQ participation

Claire Marchand

More than a century ago, the first IEC President, Lord Kelvin, was quoted as saying: "If you cannot measure it, you cannot improve it". This is as true today as it was then. One thing that has changed since those words were uttered is the way we measure things today.

Electronic components make them, smart

The measuring and monitoring is no longer restricted to the industrial world. Whether at work, at home, traveling, at the gym, sleeping, our days and nights revolve around the multitude of smart electronic devices that help us monitor and measure our professional and personal achievements, our health, our physical and intellectual performances.

None of that would be possible without electronic components. They are at the heart of the smart world we live in, mostly hidden from view but essential to the smooth functioning of any device, piece of equipment or system. The automotive sector and transportation in general, healthcare, entertainment, to name a few, have all benefitted from the numerous and rapid technological advances of the electronics industry.

Omnipresent

We don't see them but we trust them implicitly. Most of us don't even know what they are, what they look like. The only thing that we are sure of is that they are reliable, that we can

Russian NC Vice-President Alexander Zazhigalkin opened the workshop

IECQ Secretariat Business Manager Steve Allan toured the Electronstandard facilities...

depend on them to provide us with the information they help gather, whether it is our heartbeat, our electricity consumption or the speed of a factory production line.

IECQ at the heart of it all

One organization, IECQ, the IEC Quality Assessment System for Electronic Components, plays a major role in ensuring that all electronic components are of the highest quality. Electronic component manufacturers and suppliers, electronic equipment manufacturers and, ultimately, consumers, can be confident that products tested and certified by IECQ are genuine and can be trusted.

Reaching out

IECQ is sparing no effort to promote its services throughout the world. In May 2014, for example, the Russian NC (National Committee) of the IEC invited the IEC and IECQ to present the System to the Russian industry during a workshop held at the Federal Agency for Technical Regulating and Metrology in Moscow.

Alexander Zazhigalkin, Vice-President of the Russian NC opened the session with a presentation on the "Role of standardization in the issues of production quality management". Then the major part of the workshop was devoted to IEC and IECQ. After a brief introduction on the IEC and its standardization and CA (Conformity Assessment) activities, Steve Allan, Business Manager, IECQ Secretariat, spent time explaining how "IECQ empowers Industry with supply chain compliance tools".

The whole scope

The topics covered included: IECQ AP (Approved Process), IECQ AC (Approved Component), IECQ Avionics, IECQ HSPM (Hazardous Substances Process Management) and two more recent IECQ programmes: IECQ AC-AQP (Automotive Qualification Programme) and IECQ AP-CAP (Counterfeit Avoidance Programme). Allan also briefly introduced the IECQ LED initiative, noting global concerns with the reliability of LEDs and how IECQ's Approved Component Scheme provides a vital role in managing the component supply chain.

Around 70 participants – among them certifiers, industry representatives and university students – attended the workshop and expressed a keen interest in the System and what its Schemes offer. In particular, they were pleased to learn that, under the IECQ AC and AP Schemes and in the absence of relevant IEC International Standards, they could use industry or nationally-accepted specifications and standards in the absence of an IEC International Standard.

Further discussions with the Russian NC were extremely fruitful. The idea of establishing a Russian IECQ training body was raised and the NC committed to provide technical experts for IEC TC (Technical Committee) 107: Process Management for avionics, and for all IECQ Working Groups, included the newly-formed WGT in charge of training.

Renewed collaboration in the pipeline

Moreover, the Russian CB (Certification Body) expressed the wish to reenter the IECQ System and, together with the NC, plans to attend the next IECQ annual meetings, to be held in Singapore in 2015.

Back to back with the workshop, IECQ was taken on a tour of Electronstandard, the Russian Scientific Research Institute, and former IECQ CB, located in St Petersburg. High-level technical discussions centered on resuming participation in IECQ. Allan gave a step-by-step explanation of how this can be achieved, listing the acceptance requirements and what needs to be done, for example internal procedures.

State-of-the-art facilities

The actual tour of the facilities showed Allan that the technical capabilities of the testing lab were state-of-the-art and outstanding. Of particular interest was the Programme for Counterfeit Avoidance set up by Electronstandard. This led to the decision to have one of their experts participate in the work of IECQ WG 06: Counterfeit Avoidance Programme.

The outcome of the workshop and the visit to Electronstandard was extremely positive for all with both organization keen to have more sector-specific training and workshops, especially in the avionics and automotive fields, and to participate in IEC CA joint seminars and IECQ annual meetings.

For more information on IECQ: www.iecq.org

...where his hosts provided information on the state-of-the-art technical capabilities of the testing lab

International certification for solar, wind and marine energy

IEC launches IECRE, the new CA System for the renewable energy sector

IECRE comprises three Sectors: solar PV…

Claire Marchand

The ever increasing demand for electricity and the need to reduce the share of fossil fuels in power generation have led to rapid development and growth of the RE (renewable energy) sector. The IEC, which has been at the forefront of international standardization in the wind, solar and marine energy fields for many years, has now gone a step further and launched IECRE, the IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications.

Fast-paced developments

The establishment of IECRE was formally approved by IEC CAB (Conformity Assessment Board) at its June 2013 meeting. The objective was to create an international CA (Conformity Assessment) System providing testing, inspection and certification for renewable energy sectors such as wind energy, marine energy and solar PV (photovoltaic) energy.

The CAB approval led to the setting up of the IECRE Forum, a working group bringing together stakeholders from the renewable energy sector as well as officers and leading experts from the IEC CA side. The Forum, in charge of drafting the new System's Basic Rules, met in October and November 2013 and again in early April 2014 to discuss and finalize the draft document. IECRE Basic Rules were approved by CAB at its June 2014 meeting.

The fast pace set by CAB and the IECRE Forum was made possible by the work previously undertaken by two CAB working groups, WT CAC (Wind Turbine Certification Advisory Committee) and WG 15: Marine Energy. These two groups had done in-depth analyses of their respective sector's CA needs and requirements, thus paving the way for rapid development of IECRE.

Sectors and Schemes

Practically speaking, the IECRE System will be organized in sectors and schemes. Three sectors have currently been defined:

- Solar PV Energy
- Wind Energy
- Marine Energy

Each of these sectors will be able to operate Schemes that cover:

- Products, e.g. components and systems
- Services, e.g. installations and other related offers of the sector
- Personnel, e.g. covering the competence of those working in the sector

A lot in common

Commonalities can be found in the technologies used for generating

...wind...

energy from the sun, the wind or the oceans: high capital investment and harsh environmental conditions in installation deployment, the need for a systems approach to cover stages from design concept to prototype, to production of equipment and components, transportation, installation and commissioning.

Marine energy

Oceans offer an enormous source of renewable energy with the potential to satisfy an important percentage of the world's demand for electricity. While research and development in this field has been ongoing for many years, the technologies used to harness the energy from waves and from tidal and water currents are still developing. Development of a Conformity Assessment System under the IECRE will allow the marine industry to establish rules and requirements for testing and certifying the design, materials, components. It will allow the marine industry to build and then certify devices to IEC International Standards developed by IEC TC (Technical Committee) 114: Marine energy - Wave, tidal and other water current converters. This is a crucial step towards improving the overall economic viability and acceptability of marine technologies and ultimately will help the whole industry to develop and grow.

...and marine energy

Solar PV energy

As solar power is set to occupy a growing share of the global energy mix, PV (photovoltaic) energy generation has been expanding dramatically in recent years. The IECRE will seek to provide a dedicated testing and certification scheme covering products and installations by verifying their compliance with specified IEC International Standards prepared by IEC TC 82: Solar photovoltaic energy systems.

Wind energy

Wind turbines are being built throughout the world. The manufacturers, buyers and plant owners want to be assured that wind turbines, including their components and their installations are of the required quality and reliability, as specified in IEC International Standards developed by IEC TC 88: Wind turbines. The IECRE Conformity Assessment System will seek to help minimize incoming inspection costs and largely eliminate the need for quality auditing of suppliers. The System, and the conformity assessment solutions that are developed, will be intending to facilitate quality assurance and reduce certification costs by preventing wasteful duplication of testing and assessments.

Potential developments

While IECRE focuses on these three sectors for now, the door remains open for consideration of other technologies such as CSP (concentrated solar power), geothermal energy and fuel cells.

Expanding trade opportunities for Euro-Asian countries

IEC and EASC sign renewed Cooperation Agreement

The IEC-EASC Cooperation Agreement will help expand trade opportunities

Janice Blondeau

The IEC and EASC (the Euro-Asian Council for Standardization, Metrology and Certification) recently renewed their Cooperation Agreement, which will help to expand trade opportunities for EASC countries.

Broad access to world markets

This Cooperation Agreement aims to enable the commercial exchange between and beyond EASC member countries. Market harmonization based on IEC International Standards will allow EASC countries to limit dependencies and to buy electrotechnical products and systems that are able to work with each other from millions of suppliers anywhere in the world.

When countries and companies can reach global markets, trade increases and market growth and development are stimulated. Only globally relevant IEC International Standards provide broad access to the world. National or regional standards do not.

International Standards = global benefits

This new Cooperation Agreement enables and encourages EASC members to give absolute preference to International Standards over any regional or national standards, simply because they are the only ones to be able to offer such global benefits.

Many national or regional standards are only fully relevant in their own geographic area, no matter how big that is. For example in Europe, despite the fact that nearly 80% of standards are built on or even identical to IEC International Standards, it is the national and regional differences that limit global market access, trade and choice in terms of suppliers.

Active participation is key

Adopting existing International Standards for national use is good. However, it is even better for a country or region if it can influence the content of those Standards through active participation because this increases their relevance and stimulates broader use.

Less duplication of effort

The Agreement also aims to avoid duplication of efforts by ensuring that technical reviews of standard content takes place at the international level.

Aleksei Abramov, representing EASC, and Frans Vreeswijk, IEC, signed the Cooperation Agreement

IEC International Standards and Conformity Assessment Systems remove technical barriers to trade between countries and regions

EASC member bodies (including non-IEC members) will become more informed about IEC activities and are encouraged to participate at the international level in IEC standardization and conformity assessment work.

This Cooperation Agreement is a revision of the IEC/EASC Agreement dated 11 November 1998.

About the EASC

The Euro-Asian Council for Standardization, Metrology and Certification, which is headquartered in Belarus, was created in 1992 to coordinate the works of its members – Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Russian Federation, Tajikistan, Turkmenistan, Uzbekistan, Ukraine – in the field of standardization, metrology and certification and to define the main directions of interstate standardization.

More than 230 interstate technical committees for standardization were created under the Council.

IEC on the world energy stage

Innovation and the new generation of energy systems

Janice Blondeau

IEC joined the heads of the world's leading electricity companies in discussions on the theme of innovation and the energy systems of new generation at the recent GSEP (Global Sustainable Electricity Partnership) annual summit in Moscow, Russia.

GSEP promotes sustainable energy development via electricity sector projects and training programmes for developing nations

Meeting with world electricity leaders

The IEC was represented by Past President Jacques Régis and Katharine Fraga Pearson, IEC Head of Governance and Global Strategy.

Participating in the session "Global Energy Systems of the New Generation" Régis said that the IEC provides a global platform that enables technologies, both existing and new, to be used in the best way for maximum performance reliability.

New generation solutions

The development of IEC International Standards, for example, for UHV (ultra-high voltage) and RE (renewable energy) helps to advance global energy systems of the new generation.

IEC Past President Jacques Régis emphasized that IEC International Standards help facilitate the take-up of new technologies

GSEP looks forward

For GSEP's members, future energy solutions need to address the priorities of ensuring security of supply while providing affordable energy that is sustainable and environmentally friendly. One such solution is the creation of flexible and adaptive energy systems consisting of several key elements: smart grids and energy storage well integrated with electricity generation and distribution systems, regional energy hubs and long-range ultra-high voltage lines.

IEC International Standards are fundamental for these innovations and other new technologies to be realized.

The GSEP Moscow Summit, held at the end of May 2014, was hosted by RusHydro, the 2013-2014 outgoing Chair Company of the organization.

About GSEP

The GSEP was created in 1992 in the context of the UN Rio Earth Summit, with the aim to promote sustainable energy development through electricity sector projects and training programmes for developing nations. The original GSEP founders, Électricité de France and Hydro-Québec, invited the chairmen of some of the largest electric utilities among G7 countries to create an international group.

Innovation and the new generation of energy systems was the theme of the 2014 GSEP Summit

Upcoming global events

Special deals for IEC experts

The IEC regularly lends its support to key global and regional industry events allowing them to put forward IEC endorsement on their website and materials. We would like to draw your attention to several IEC-endorsed events that may be of interest to the IEC community.

IEC endorses key global and regional events

Indonesia Light+Building Expo
Jakarta, Indonesia
14-16 August 2014

The international trade fair for architecture and technology brings together in one event all the fields pertaining to architectural lighting, building and landscape illumination, decorative lighting, showcase lighting, display system, general lighting, ecofriendly lighting, hazardous lighting, industrial lighting, interior illumination, LED display, LED lighting, lighting accessories, parts and components, lighting management, design and technology, power supply, sign equipment and accessories, special purpose lighting, street lighting and more.

IEC experts benefit from a 15% discount. Please contact: Ms.Monica Anggraeni at monicaanggraeni@gmail.com

Hydropower Development Europe 2014
Porto, Portugal
17-18 September 2014

Hydropower Development: Europe 2014 Summit, organized by ACI (Active Communications International), will take place on 17-18 September 2014 in Porto, Portugal. The event will comprise two days of formal presentations, interactive panel discussions and excellent networking opportunities, focusing on current operational and future planned hydro power plants, energy markets reform, potential barriers and support policies as well as project economics and finance.

IEC experts are entitled to a 15% discount off their conference package (code: EHP1_MP).
For more information, please call +48 616 467 025.

InnoTrans 2014
Berlin, Germany
23-26 September 2014

InnoTrans, the International Trade Fair for Transport Technology, Innovative Components, Vehicles, Systems, is the established international industry showplace for railway technology. Features include railway infrastructure, interiors, public transport and tunnel construction. The event brings together international representatives from public and private transport companies and operators; manufacturers and suppliers of transport technology; construction companies; engineering; trade associations and institutions and many more.

IEC 61850 Europe 2014
Prague, Czech Republic
14-16 October 2014

The 2nd annual IEC 61850 Europe 2014 will focus on “Driving the Large-Scale Deployment of IEC 61850 across TSO and DSO Smart Grid Infrastructures”.

IEC 61850 Europe 2014 is now firmly established as the conference, exhibition and networking forum that specifically addresses the information and implementation needs of the European end-user community; TSOs and DSOs. This year’s programme reveals the success criteria that are driving large-scale deployment of the Standard within leading TSO and DSO organizations. The event includes case studies, tech innovator panel discussions, workshops and group discussions, a solution zone and networking.

IEC experts benefit from a special 10% discount (promotion code: IEC61850-14-IEC).

Please let us know if you feel a global/regional event in your industry would benefit from IEC endorsement: info@iec.ch

Persistence pays off

Profiling Jonathan Colby, marine energy expert and IEC Young Professional Leader

Janice Blondeau

Participation in the IEC Young Professionals programme has been a catalyst for Jonathan Colby to become much more deeply involved in both the international standardization and conformity assessment work of the IEC.

In the beginning...with TC 114

Colby, a hydrodynamic engineer by training, was recently named the Director of Technology Performance with Verdant Power. His initial IEC involvement was as a US representative on IEC TC (Technical Committee) 114: Marine energy - Wave, tidal and other water current converters, as a subject matter expert in developing standards for the assessment of power performance for tidal energy converters.

One thing leads to another

In 2011, Colby was nominated as a US participant in the IEC Young Professionals programme and elected as one of the three IEC YP 2011 Leaders. He also participated in the YP workshops in Oslo in 2012 and New Delhi in 2013.

While observing the CAB (Conformity Assessment Board) meeting during the IEC General Meeting in Oslo, as part of the Young Professionals workshop, Colby learned of CAB WG 15 which had been set up to investigate the CA needs for the marine renewable energy industry. At the time neither Colby nor the company that he works for, a leader in the field, were aware that this was an IEC project.

Conformity Assessment in marine renewable energy

"As I sat in that CAB meeting, I was totally convinced that my company, Verdant Power, needed to be represented on that CAB working group.

"Following the observation of the CAB meeting we had lunch with the CAB members. At that lunch I specifically sought out Chris Agius, the convenor of CAB WG 15, and expressed my interest in joining it, especially because of the impact it would have both on my company and the industry in which my company is active in."

Jonathan Colby with Young Professionals, 2013 workshop, New Delhi

Sitting at the table brings opportunities

"Luckily they had a CAB WG 15 meeting the next day in Oslo, which I was able to attend as an observer. I was the only tidal energy developer who was sitting at the table…so I was even more convinced of the importance for my company to have me serve on CAB WG 15."

After the General Meeting in Oslo concluded, Colby actively pursued a role in CAB WG 15 and he was nominated and elected as a subject matter expert through the USNC (US National Committee) to the IEC.

At a subsequent CAB WG 15 meeting in Singapore in early 2013, it was announced that the wind energy industry, the solar energy industry and the marine energy industry were interested in starting a new IEC Conformity Assessment System for renewable energy.

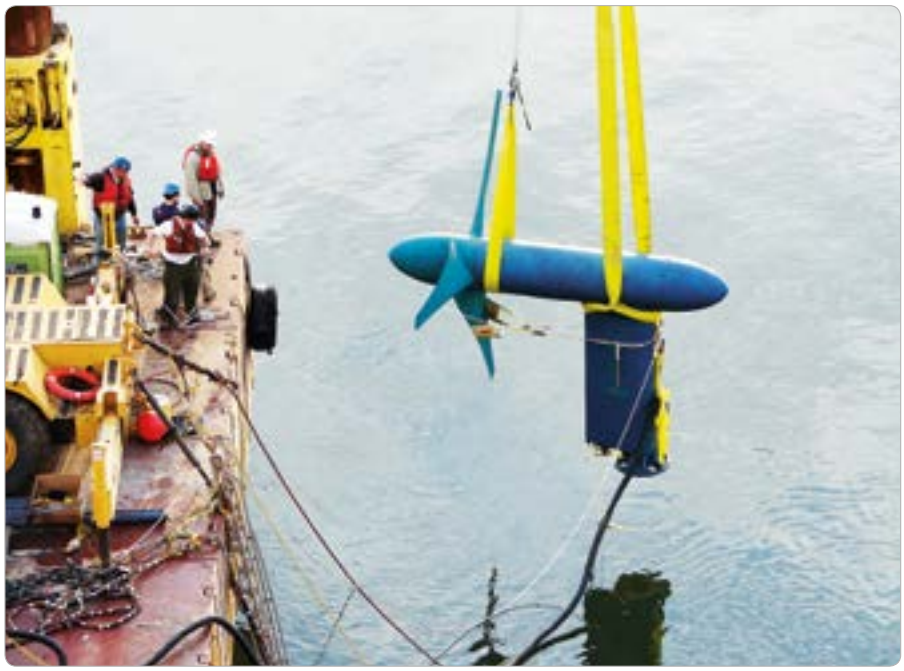
IECRE involvement

Colby again expressed interest in participating in the development of the new System. Since then, the CAB has accepted the proposal from WG 15 to develop IECRE, the new IEC CA (Conformity Assessment) System for Renewable Energy. As a member of the IECRE Forum, Colby supported the development of the IECRE Basic Rules. He is also active with the USNC developing a Member Body to the new IECRE, in conjunction with the solar PV and wind sectors in the US.

A subject matter expert in standards for the assessment of power performance for tidal… (Photo: Verdant Power)

"When I started I was only working on TC 114, serving as a subject matter expert on an individual project team. Since that time and in great part due to the IEC YP programme, my role in the IEC has expanded significantly."

Today, Colby is a member of the CAB WG 15 as a subject matter expert, and he is convenor of an ahG (*adhoc* Group) in TC 114 on the work for which he is a subject matter expert. He is also convenor of a Project Team within TC 114 on river energy. Further, Colby has been elected as the TA (Technical Administrator) for the US Technical Advisory Group, effective 4Q, 2014. As TA, he will represent the United States as Head of Delegates at TC 114 meetings and lead the activities within the United States.



…energy converters, Colby is active in TC 114, CAB WG 15 and the IEC YP programme (Photo: Verdant Power)

Advice for up-and-comers

"If I had to give one piece of advice to Young Professionals and up-and-coming experts in the IEC, it would be that the ability to participate and become engaged is a function of the effort that you put into it.

"I would really encourage other YPs and people new to the IEC to find out what they are interested in and really push to be involved. It's your own self-motivation that's one of the most important tools you can utilize to get involved."

Young Professionals programme opens doors

"The IEC Young Professionals programme has opened an incredible number of doors for me. I've become much more engaged both at national committee level and at the IEC level. With my experience, I've been encouraged to take on significant leadership roles at the IEC and within the United States and as a result, I've been able to elevate the global visibility of the marine energy industry."

Colby notes that access to management of the IEC, to the members of IEC governing bodies, as well as to members of standards bodies in the US are all opportunities that have resulted from his participation in the IEC Young Professionals programme.

Colby was also awarded the ANSI (American National Standards Institute) Next Generation Award (2012), which honours individuals who have been engaged in standardization or conformity assessment activities for less than eight years and who have, during this time, demonstrated vision, leadership, dedication, and significant contributions to their chosen field of activity.

Calling Young Professionals

Janice Blondeau

An introduction to the South African chapter of the IEC Young Professionals programme.

IEC Young Professionals workshop, Oslo 2012, including YPs from South Africa

South African chapter launched

In early May 2014, a milestone was reached when the South African Chapter of IEC Young Professionals programme was officially launched.

High calibre panel

As well as Young Professionals from across the country, launch attendees included Frans Vreeswijk, IEC General Secretary and CEO; Boni Mehlomakulu, CEO of the South African Bureau of Standards; Pat Naidoo, President of the South African Institute of Electrical Engineers and Rob Stephen, Master Specialist in technology at the South African power utility, Eskom.

Growing the next generation of experts

With a membership of almost 80 people the South African Chapter of IEC Young Professionals programme shows just how interested young South Africans are in electrotechnical standardization. The chapter also has ten mentor members who have joined with the intent of mentoring YP members in various fields of electrotechnology and standardization.

In May 2014 South Africa launched a chapter of the IEC Young Professionals programme

An opportunity for South Africa

With the vision of enabling young South African professionals to become national and international experts in standardization and conformity assessment, the South African Chapter has made many excited about the future of electrotechnical standardization. It hopes to provide a large group of technical experts to support the IEC work in the near future, as well as to work in national standardization and conformity assessment activities.

One of the core themes presented to the Young Professionals at the launch was that South Africa and the rest of the world are realizing just how important standards are in the development of a country. Moreover, industries, governments and institutions will be looking to Young Professionals through the development and appropriate application of standards and conformity assessment schemes to address some of the economic, technical and environmental problems that the country and the world are facing.

The next workshop

The IEC Young Professionals 2014 workshop will take place in Tokyo during this year's General Meeting.

Both participants from previous years and their employers have provided very positive feedback about the workshop and the benefits that it brings.

The IEC Young Professionals - 2014 workshop will take place in Tokyo in November during the IEC General Meeting

Appreciation for the IEC Young Professionals programme

"Our company's representative's participation in the IEC 2011 YP program gave her a global view of the standardization community. Her participation in this programme was taken into account, among other factors, when selecting her as the company representative within several IEC Committees. It is of the utmost importance for our company to integrate approval engineers from the early stages of product development and also to continuously follow National, Regional and International normative and committee discussions in order to develop products that can be certified globally.

We therefore highly appreciate activities like the IEC Young Professionals programme which further develop our younger approval collaborators".
BSH (Bosch and Siemens Home Appliances), employer of an IEC Young Professionals 2011 workshop participant

Insights into standardization

"IEC YP Workshop has provided the participants with great insights on the world of standardization. It is definitely a great place to be with all the friends that we made."
Vincent Wiguna, IEC 2013 Young Professional

Company and individual benefits

"The IEC Young Professionals workshop is a great opportunity to meet people from the industry from all over the world, share international experience and cultural aspects. Also the workshop has helped me to recognize the need for International Standards and to understand the difficulties in the realization of standards. The IEC YP workshop was a great benefit for my private and professional life!
Michael Imseng, IEC 2013 Young Professional

Happy birthday PKN!

PKN (Polish Committee for Standardization) celebrates its 90th anniversary this year

PKN is celebrating its 90th anniversary this year

Zoë Smart

To honour the occasion, a conference entitled "Standardization – how to rise to challenges of the future?" was organized in May.

In the beginning

A first meeting was held in 1924 and after the name 'Polish Committee for Standardization' was adopted that same year PKN was born, signalling the beginning of standardization at the national level. Particularly active since its inception, PKN has contributed in a major way to the development of international standardization, notably as a member of the IEC.

2014 a milestone year

2014 also marks ten years of PKN's membership in the European standardization organizations CEN and CENELEC. Since 2004 PKN has been contributing to the consolidation of the Single European Market through active participation in standardization work at European level.

To mark the two milestones as well as Polish Standardization Day,

Tomasz Schweitzer, PKN President, addresses attendees at the organization's anniversary conference in May

Jolanta Kocharńska, Vice President of PKN, talking at PKN's anniversary conference

celebrated on 20 May, a conference entitled "Standardization – how to rise to challenges of the future?" was organized. Attended by state administration representatives, consumers and entrepreneurs, the event proved to be a big success and set the tone for the next ten years to come.

Benefits of IECEx certification

AFSEC-IECEx seminar for the mining sector in Africa

Claire Marchand

AFSEC (African Electrotechnical Standardization Commission) and IECEx (IEC System for Certification to Standards relating to Equipment for Use in Explosive Atmospheres) are organizing an international seminar in Lumumbashi, Democratic Republic of the Congo, on 7-8 September 2014. The event is organized in collaboration with AFREC (African Energy Commission) and OCC (Office Congolais de Contrôle), and in partnership with the Katanga mining authorities and Moïse Katumbi Chapwe, the governor of the Katanga Province.

The seminar will take place in Lumumbashi, Katanga Province…

Who should attend?

The seminar will provide a unique opportunity to learn about IECEx and the benefits of using the System. It is for experts, senior staff and professionals from the mining and electrical sectors in African countries who are involved in the standardization, manufacturing, inspection, repair, exploitation, maintenance and overhaul of equipment, specifically in mines.

A pragmatic approach

Day one of the seminar will be devoted to the implementation of IEC International Standards and day two to a site inspection with practical exercises, report and explanation of findings. The seminar will focus on the three following International Standards:

- IEC 60079-10-1, *Explosive atmospheres - Part 10-1: Classification of areas – Explosive gas atmospheres*
- IEC 60079-10-2, *Explosive atmospheres - Part 10-2: Classification of areas - Combustible dust atmospheres*
- IEC 60079-17, *Explosive atmospheres - Part 17: Electrical installations inspection and maintenance*

The technical presentations will deal with daily problems participants are facing when using equipment in explosive atmospheres, including

…in the southernmost part of the DRC

issues of area classification and the inspection and maintenance of electrical installations.

Sharing and networking

The seminar will be conducted in English and in French by two IECEx experts, Paul Meanwell (English group) Michel Brénon (French group), who will share their experience and knowledge, answer questions and provide advice, information and background material.

Practical information

There will be two sessions, one in English and one in French, each of which will welcome 40 participants.

If you wish to participate, you can register on the AFSEC website

A mine in Katanga, DRC (Photo: Thierry Michel)

Chairmen and Member nominations

A roundup of the latest nominations approved by the SMB (Standardization Management Board)

Zoë Smart

IEC TC (Technical Committee) 121 has welcomed its new Chairman and SG (Strategic Group) 6 has a new Japanese NC member.

New Chairman for TC 121

Helmut Drebenstedt is the new Chairman of IEC TC 121: Switchgear and controlgear and their assemblies for low voltage. Drebenstedt holds a Doctorate in Engineering and is Head of a test laboratory for LV switchgear and controlgear assemblies at Siemens AG in Leipzig. He has been active in standardization activities since 1994 and received the IEC 1906 Award in 2007. Drebenstedt has been appointed Chairman of TC 121 for the period 2014-05-31 to 2020-04-30.

Other nominations

SMB has also approved the extension of the term of office of Serge Theoleyre, as French member of ACEA (Advisory Committee on Environmental Aspects). ACEA, which reports to the SMB on environmental matters, ensures that the IEC's standard developers take environmental protection concerns into account in their standardization work.

Hidenori Tomioka is the new Japanese NC member of SG 6: Electrotechnology for Mobility. The SG analyses market and latest industry developments in order to provide recommendations to the SMB for an IEC strategy encompassing the complete domain of automotive electrotechnics and electromobility.

Helmut Drebenstedt is the new Chairman of IEC TC 121

Obituary

Jeffrey Allan DesJarlais passed away unexpectedly on 10 July 2014 at the age of 52

The IEC family was greatly saddened by the passing of DesJarlais whose expert knowledge contributed to IEC work through his active involvement with the organization for the past 9 years. He was in St Petersburg for an IEC Working Group meeting at the time of his death.

A keen interest in standardization

DesJarlais received his Associate in Science degree from the Michigan Technological University and later a BSEE from the Illinois Institute of Technology. He was hired by UL (Underwriter Laboratories) on 11 March 1985 and remained with the company for the next 29 years where his last position was 'Principal Engineer – Industrial Control Equipment, Personnel Protective Controls & Robotics'.

His involvement with the IEC began in October 2005 when he joined the then IEC 17B/WG2 (now IEC SC 121A/WG2: Low-voltage switchgear and controlgear/contactors, starters and similar equipment). He was also a member of TC 109: Insulation co-ordination for low-voltage equipment.

DesJarlais will be fondly remembered by all those who had the privilege to know him. The IEC's deepest sympathies go out to his family and colleagues.

Jeffrey Allan DesJarlais 1962-2014

Obituary

Craig K. Harmon, President and CEO of Q.E.D. Systems Inc and standards professional

Craig K. Harmon passed away at the age of 67 on 3 July 2014. Harmon founded Q.E.D. Systems, a consulting firm focused on standards development and education related to bar codes, RFID, and other automatic identification technologies in 1981 and spent more than 33 years as the company's leader.

A key player in bar code and RFID technologies

With a keen interest in bar code and RFID (radio-frequency identification) technologies, Harmon played a vital role in the development of related International Standards and was an important figure in the AIDC (automatic identification and data capture) industry.

He played a significant role in the formation of ISO/IEC JTC1: Information Technology, SC (Subcommittee) 31: Automatic identification and data capture techniques, and served as the convenor of its WG (Working Group) 6: Mobile Item Identification and Management.

Harmon was the author of two books on bar code technology and wrote many articles on topics related to RFID, the global supply chain, and the IoT (Internet of Things), among other subjects.

Craig K. Harmon 1947-2014

e-tech to go

e-tech fans can now read the IEC magazine anytime, anywhere

The recently launched e-tech *app is available for tablets and smart phones*

Zoë Smart

Following a number of requests by attendees at the IEC 2012 General Meeting in Oslo, Norway, the IEC has developed an app that allows readers to access *e-tech* magazine online in a smartphone and tablet-tailored format and save it for reading offline as well.

An app for iOS and Android devices

Readers of the magazine, which provides the latest IEC news and developments in the electrotechnical Standardization and Conformity Assessment fields, expressed the wish to be able to read the magazine offline, a feature they said would be particularly useful when travelling or when having limited access to wifi. The app is designed for both iOS and Android mobile devices.

Features for easy reading

Once the app has been installed, users see the latest issue and have the possibility to scroll through back issues. They can download those of interest and 'leaf' through them anytime, even when offline. The app also gives users the possibility to zoom into the page and bookmark pages for easy reading. Each issue is also fully searchable, and can be shared as a pdf via email.

The app has a variety of features for easy reading

Download the app today on your mobile device!

The *e-tech* app is available on iTunes (for iOS devices) and Google Play (for Android devices).

Supporting rural electrification

IEC series of publications to help rural populations in developing world access electricity

Morand Fachot

Hundreds of millions living in rural areas in developing countries are without access to electricity, a prerequisite to human and economic development. Off-grid renewable energies offer an attractive solution for these people. The IEC has issued a series of publications for small renewable energy and hybrid systems for rural electrification, which is available at a discounted price in a joint initiative with the World Bank Group and the United Nations Foundation.

Remote or no prospect of grid connection

Many people in developing countries are deprived of the benefits of

Solar PV panel covering battery cabinet in Gabon (Photo: Meagle Sun)

Installing a PV panel on a roof in Liberia (Photo: Pickering Energy Solutions)

access to electricity as a result of an inadequate infrastructure. As a result they are denied access to many economic and socio-cultural benefits.

As prospects from grid-connectivity are rather remote, if not totally inexistent, off-grid electrification that relies on REs (renewable energies), that is essentially solar PV (photovoltaic) systems appears as the most realistic and suitable solution for these regions.

Comprehensive work

For more than 15 years IEC TC (Technical Committee) 82: Solar photovoltaic energy systems, has been developing publications that set out recommendations aimed at guiding the introduction and use of REs in rural decentralized electrification.

This work has so far resulted in the development of the IEC/TS 62257 series of 18 publications that includes, among other things, general requirements for the design, erection and operation of microgrids and micropower plants; recommendations for small renewable energy and hybrid systems; and the selection of components.

In addition to requirements to ensure the safety of persons and property, and recommendations concerning operation, maintenance and replacement as well as project development and management, these publications cover also the following:

- system selection and design
- selection of self-ballasted lamps (CFL)
- selection of PV-IES (PV individual electrification systems)
- selection of stand-alone lighting kits for rural electrification
- selection of batteries and battery management systems
- various types of generators - Photovoltaic generators
- details of microgrids and micropower systems.

Boys studying thanks to a solar lamp (Photo: d.light design)

Easier, cheaper access for key stakeholders

The IEC has responded positively to a request from the United Nations Foundation to make the IEC/TS 62257 technical specifications more easily available to key stakeholders in developing countries. This request was reinforced by the conclusions of a 2012 workshop on rural electrification held by AFSEC (African Electrotechnical Standardization Commission) with experts from IEC TC 82. As result of that workshop, AFSEC is developing a technical guide for sustainable off-grid electrification, with reference to IEC/TS 62257 series.

The IEC, World Bank Group and United Nations Foundation have worked together to give access to the IEC/TS 62257 series to key stakeholders at discounts ranging between 50% and 75%. Details are available from the IEC Webstore.

3D printing, printed electronics and more

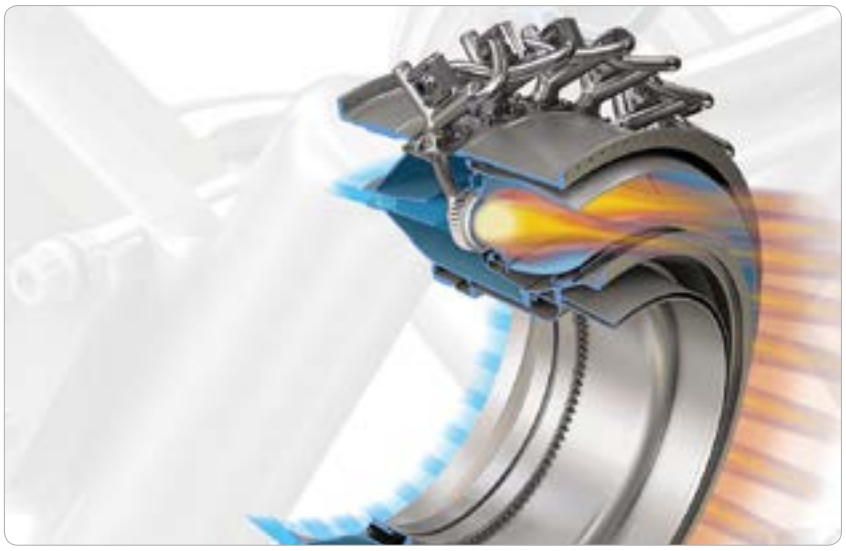
3D printing has been a buzz-word for quite some time. Together with nanotechnology, printed electronics and optical interconnection in IT and other electronic systems, they represent disruptive technologies which are moving from the lab and R&D stages to deployment in the manufacturing world.

3D printing, widely linked to in the public's mind with the production of prototypes or small devices and toys is being introduced in leading-edge industries such as aerospace. Nanotechnology is often associated to new types of materials and substances and their potential related health impacts. What is less known is that the term also applies to a wide variety of electrotechnical applications from semiconductors, nano-composites, nano-electrodes to microfabrication and organic and printed electronics.

Printed electronics can now be found in countless products, helping make them lighter and more energy efficient, among other things. It has opened a vast array of new applications from flexible displays to lighting, textiles, batteries, sensors and more.

As for optical interconnection in IT and other electronic systems, it is set to dramatically increase their computing power and speed as well as their storage capacity.

Issue 06/2014 looks at how IEC covers the standardization needs of these rather new technologies and the impact they will have on many industrial sectors as well as on a wide range of electrical and electronic products and systems.



e-tech

News & views from the IEC

This is a special printout of IEC *e-tech* our electronic publication. You can find a link to *e-tech* on the IEC homepage, or you can access it at www.iec.ch/etech

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