SMART CITIES / SMART GRIDS

TECHNOLOGY FOCUS
Smarter buildings in Smart Cities
A holistic approach to infrastructure

INDUSTRY SPOTLIGHT
Standards matter in Smart Grids

IEC WORLD
IEC International Forum on medical equipment
World Standards Day video competition

IN STORE
EVs charging wirelessly
The Internet of Things is emerging as a main driver in the development of smart buildings. The need to make cities sustainable will drive the adoption of a range of smart solutions. Cyberattacks on healthcare establishments are a growing threat. The IEC developed tools to help find the right International Standard for Smart Grid with minimal trouble. Communication between equipment and systems is increasingly important for electric power grids. Future electric vehicles may not need to plug in to charge their batteries.

Smart Cities / Smart Grids

Issue 06/2015 of e-tech focuses on developments in the Smart Grid and Smart Cities domains, with reference to relevant IEC work in these areas. It also looks at the important role the Internet of Things (IoT) is set to play in Smart Cities enhancing the capability of Building Energy Management Systems to optimize energy use. Standardization work by IEC TCs 8 and 57 plays a central role in the development of Smart Grid and Smart Cities.

EDITORIAL
Smart, smarter, smartest  

TECHNOLOGY FOCUS
IoT to make buildings and cities “smarter”

Smart Cities require a holistic approach to infrastructure

Common Data Dictionary helps drive business forwards

Threats lurking on medical electronic data

Enhancing how you see the world

Medical biometrics improve patients’ care

INDUSTRY SPOTLIGHT
Finding the right Standards for Smart Grids

Keeping the body shipshape

Always safer medical electrical equipment

CONFORMITY ASSESSMENT
Energy-efficient living

Powder and dust: a risky business

Safety inside out

IEC FAMILY
Smart Grid in the power sector

IEC 2015 Awards

Latest nominations and extensions

IEC WORLD
Health really matters

Celebrating World Standards Day 2015

Upcoming global events

IN STORE
EVs charging wirelessly

Standard for medical device software
A recent United Nations report revealed that, in 2014, 54% of the world’s population were living in urban areas, a proportion that is expected to increase to 66% by 2050. Furthermore, there were 28 mega-cities with 10 million inhabitants or more worldwide in 2014. By 2030, the world is projected to have 41 mega-cities.

To deliver services and maintain an acceptable quality of life for their citizens, cities need to get smarter and make more efficient use of resources.

Smart cities require a systems approach, data mining and electronics. But more than anything, they need a constant and reliable access to electrical energy. Already today, electricity enables most of the basic city services, including lighting, water, waste management, transportation, security, communication, financial transactions and administration to name but a few.

IEC has a specific role to play in the elaboration of Smart City Standards. Delivering the full value of Standards to accelerate the development of Smart Cities and lower its costs also clearly needs a strong collaboration of all city stakeholders.
IoT to make buildings and cities “smarter”
The Internet of Things is emerging as a main driver in the development of smart buildings

Peter Feuilherade
As smart commercial buildings become incorporated into the wider energy control networks of smart cities and linked to other aspects such as transport, water and air quality, the increasing intelligence and automation of buildings will play a key role in the smart cities of the future.

Growing urbanization to drive smart cities’ expansion
During the next decade the number of smart cities around the world is forecast to rise substantially, driven by the growing trend of urbanization as migration from rural areas accelerates. China and India alone are planning hundreds of smart city pilot projects. However, not all of these will materialize, and Europe and North America will probably still account for about half of the planet’s smart cities. Estimates by industry analysts predict that the global smart city market will be worth around USD 1 200 billion in 2019.

IEC to play central role in fast-growing market
The IEC Standardization Management Board (SMB) set up a Systems Evaluation Group (SEG 1) on Smart Cities in 2013. Its work focuses on identifying the various electrotechnical systems used in these cities, with the aim of integrating and optimizing them.

Electricity and electronics are indispensable for the operation of the myriad interconnected services in smart buildings and the development of future smart building technology. Standardization is a fundamental principle here. The IEC creates and develops International Standards with an emphasis on safety and interoperability among the broad range of systems, equipment and applications used in the construction and maintenance of smart buildings.

Smart buildings and infrastructure combined are expected to account for more than 30% of the overall smart city market, according to Research and Markets, a Dublin-based business intelligence firm.

Many of the technological advances that promote efficiency and offer solutions to the challenges posed by increasing urbanization, such as water shortages, power deficits, pollution and inadequate waste water and sewage treatment capacity, are also driving the growth of the smart commercial buildings market.

Saving energy
Energy efficiency and sustainability are major features of a smart building. Buildings on average consume about 30% of the world’s energy, and savings of up to a quarter of costs could be achieved by using advanced building management systems and analytics to optimize performance in areas such as ventilation, temperature, lighting and air quality.

Technological innovations in improving energy consumption, water usage and indoor air quality, as well as access to better data about how efficiently commercial buildings are run, can increase operational efficiency, limit costs and cut consumption of resources for owners and operators. However, the high cost of initial investment versus perceived value is still a concern affecting adoption rates.

Heating, ventilation and air conditioning (HVAC) systems are intended to detect automatically and respond intelligently to variables such as weather conditions, time of day and occupancy of the building, with the help of sensors and other data gathering equipment. For example, HVAC systems in smart buildings should be able to switch...
off lights automatically in areas where there are no occupants, or adjust the temperature according to weather conditions and the number of occupants in a room.

Other elements of a smart building include sensors for detecting motion, noise, moisture, temperature, humidity, fire and smoke, carbon dioxide and hazardous gas; integration with city-wide water recycling systems and pneumatic waste disposal systems; remote surveillance, security and access control systems; and data infrastructure.

These complex and multiple interconnected systems need to communicate and coordinate with one another for buildings to work efficiently. Connectivity is ensured through the provision of a combination of wireless, fibre and mobile networks; Distributed Antenna Systems (DAS) can extend wireless and mobile network coverage with additional antenna nodes.

Many IEC Technical Committees (TCs) and Subcommittees (SCs) coordinate on the development of International Standards for smart buildings. They include IEC TC 8: Systems aspects for electrical energy supply, which focuses on the overall system aspects of electricity supply systems, and IEC TC 57: Power systems management and associated information exchange, which deals with communications between the equipment and systems in the electrical power industry, a central element of smart buildings, cities and grid projects.

**Sensors everywhere**

There is a growing market for advanced occupancy sensors, carbon dioxide sensors, thermostats and photo sensors which can gather data about movement, heat, light and use of space to adapt to changing building conditions and make real-time alterations to a building’s environment. This helps to reduce energy use and improve air quality. Navigant Research, a US-based market research and consulting firm, forecasts that global shipments of advanced sensors will grow from 1.8 million units annually in 2013 to 28.4 million units in 2020. IEC TC 47: Semiconductor devices, and its SCs develop International Standards for sensors and other systems.

**Internet of Things as building block of Smart Buildings**

The technology which forms the foundation of today’s smart buildings is known as the Internet of Things (IoT). The IoT is a global network used to interconnect embedded objects or devices such as sensors and mobile devices which are able to communicate and to generate and share data with one another.

In smart commercial buildings, the IoT will enhance the capability of Building Energy Management Systems (BEMS) to optimize energy use. In addition, Building Management Systems (BMS) involve the convergence of traditional and new hardware, software and services to improve the control and automation of building systems and manual procedures. The connectivity provided by the IoT and the ability to integrate disparate automated systems and intelligent devices for data acquisition and analytics enable BMS managers to know and anticipate the needs of an interconnected building’s occupants and share this data through internet connectivity. Data could include preferences for lighting, heating and ventilation, as well as other services such as security systems, lifts and escalators, utility meters and water and waste management. This provides commercial as well as environmental benefits in the form of improved operational efficiency, energy savings through targeted supply and faster responsiveness to changing conditions.

By 2020, there will be tens of billions of networked appliances and sensors worldwide. More than eight million BMS will be integrated with some form of IoT platform, application or service by 2020, making them part of a wider and integrated sensing and control network, according to a June 2015 report by ABI Research, an international technology intelligence company.
With mass urbanization emerging as an unstoppable trend across the world, cities need to become sustainable on many levels. The solution is to design smart solutions at all levels to help meet multiple challenges and lead to the development of smart cities.

According to a recent UN report, 54% of the world’s population were living in urban areas in 2014, a proportion that is expected to increase to 66% by 2050, when another 2.5 billion people are added to urban areas. Furthermore, there were 28 mega-cities with 10 million inhabitants or more worldwide in 2014. By 2030, the world is projected to have 41 mega-cities.

Many, if not most, services in cities and buildings are directly or indirectly dependent on electricity and electronics, and increasingly on IT systems. When Hurricane Sandy struck the northeastern United States in 2012, it brought home to millions how central electricity is to their lives. When electrical power from a central source is down, water supply is cut off, sewage overflows, fires rage out of control and all modes of communication and transportation are disrupted.

The IEC MSB project team on Smart Cities has also led to the development of another White Paper, entitled “Orchestrating infrastructure for sustainable Smart Cities”, which explains what is needed for the development of Smart Cities.

The growing amount and variety of data generated by interconnected devices from various departments in smart buildings can provide added value in terms of better building performance, energy efficiency, space utilization and predictive maintenance costs. “Flexible, secure and cost-effective cloud-based applications that can convert the vast volume of data generated by smart buildings into a decision-making platform” will help to expand the market for the IoT, according to a June 2015 report by the Frost & Sullivan research firm.

Janice Wung, Industry Analyst for Energy and Environment, Frost & Sullivan Asia Pacific, told e-tech that the future evolution of smart buildings would focus on connectivity and interoperability. “The advancement is likely to be in a form of improvement instead of new technology, in which the improvement will most probably be observed with networks (cloud deployment), protocols (open platform) and efficiency, whether it is operational or energy efficiency,” she said.

IEC standardization work in many areas is set to play a central role in the development of smart buildings.
**Need to achieve sustainability**

To prosper and avoid major issues, cities must achieve economic, social, and environmental sustainability and become “smart cities” in the future. This can only be realized by integrating their infrastructures and services to improve urban efficiencies, as is stressed in the IEC White Paper “Orchestrating infrastructure for sustainable Smart Cities”.

Technical solutions for improving overall efficiencies that are directly relevant for smart cities already exist in many domains, such as buildings, transportation, industry and services. They include energy management (generation and distribution), lighting, heating and cooling, appliances, communication networks and mobility solutions. There are hundreds of IEC International Standards that will make possible the smart integration of smart solutions for energy, buildings and homes, lighting, mobility and others. Many of the International Standards that will make cities smarter are referenced in the IEC Smart Grid Standards Map.

The Internet of Things (IoT), the network of interconnected objects or devices embedded with sensors and mobile devices which are able to generate data and to communicate and share that data with one another, is set to play a central role in smart cities (see article on IoT and smart buildings in this issue of e-tech).

**Smart energy**

Smart energy requires the optimization of electricity supply systems. This includes the integration of generation from new renewable energy sources, transmission and distribution networks and connected user installations.

IEC Technical Committee (TC) 8: Systems aspects for electrical energy supply, prepares and coordinates, in cooperation with other IEC TCs, the development of international standards and other deliverables in these areas. IEC Subcommittee (SC) 8A prepares International Standards for the grid integration of large-capacity renewable energy sources. Standards for these are prepared by IEC TC 82: Solar photovoltaic (PV) energy systems, and IEC TC 88: Wind turbines (IEC 61400 series).

Also central to smart energy are International Standards developed by IEC TC 57: Power systems management and associated information exchange. They include International Standards for communication networks and systems in substations, and for power utility automation (IEC 61850 series); for application integration at electric utilities (IEC 61968 series); for power systems management and associated information exchange (IEC 62351 series); and for energy management system application program interfaces (IEC 61970 series).

Proper energy management requires accurate metering. Multi-function, communicating “smart” meters that provide measurement of export/import energy, demand and power quality, and management of load, local generation, customer information, customer and contracts and other value added functions are essential when creating smart grids and smart cities. IEC TC 13: Electrical energy measurement and control, develops International Standards for such meters, in liaison with other IEC TCs such as TC 8 and TC 57.

**Smarter buildings**

Buildings make up 40% of global energy demand – and will soon account for 60% of it.

Smart cities need smarter, more energy-efficient buildings. Buildings use electricity for equipment and systems such as escalators, lifts, access control, heating, ventilation and air conditioning (HVAC) or appliances.

Automation can make buildings smarter. It is more advanced in commercial than residential buildings as the former are usually refurbished and modernized more frequently. Automation in buildings includes the installation of programmable thermostats, timers and sensors that switch heating off or on, ventilation, lights, escalators and other equipment such as security systems, as required.
IEC SC 47E: Discrete semiconductor devices, prepares International Standards for components used in a variety of sensors.

Other systems that make buildings smarter are alarm and electronic security systems. They encompass systems for access control, alarm transmission, fire detection and alarm, intruder and hold-up alarm and social alarm as well as those that can be connected to remote receiving and/or surveillance centres. International Standards for these alarm and electronic security systems are prepared by IEC TC 79.

Work done by ISO/IEC JTC (Joint Technical Committee) 1/SC (Subcommittee) 25/WG (Working Group) 1: Interconnection of information technology equipment – Home electronic systems, paved the way to energy management systems with its home automation/home networking standards. These allow consumers to take control of their energy use and programme their devices to a much greater extent than ever before.

A number of initiatives in countries around the world aim at having zero-energy buildings: those that produce as much energy over the year as they use. This can be achieved through the integration of renewable energy sources such as PV or geothermal, of storage systems, heat-pumps, and plug-in electric vehicles (EVs) in addition to energy conservation construction technologies and insulation.

Smart lighting
Smart lighting can be fitted in buildings. It can also be installed in public and external spaces such as streets, plazas and parking lots.

Street lighting installations, which may account for as much as 40% of local authority electricity bills, are seen as opening possibilities for providing long-term savings and good returns on investment. LED-based lighting solutions, replacing high-intensity discharge lamps, introduce tailor-made and smart solutions, in particular when combined with control nodes and various sensors which allow for remote on/off switching and some level of dimming control. LED-based lamps are also extremely energy efficient. IEC TC 34: Lamps and related equipment, prepares International Standards for lamps and related equipment, including LEDs.

Smart mobility
A major problem facing cities, which is bound to worsen in the future, lies with obstacles to mobility as more people have to commute to and from work over long distances.

Smart mobility systems and the wider introduction of EVs offer solutions to this problem.

Smart mobility systems may include driverless electric-powered vehicles running on dedicated guideways, as found in some airports and in Masdar City near Abu Dhabi, UAE (United Arab Emirates), and traffic control.
Adaptive traffic control systems, which optimize the operation of signals to improve traffic flow, and are already deployed in some urban areas, will play a growing role in smart mobility together with connected systems such as adaptive cruise control installed in cars.

EVs for both personal and public transport are needed to cut noxious emissions. They can also be integrated in a smart infrastructure when plug-in EVs communicate with the power grid and provide electricity to it or curb their charging rate, according to the grid’s needs.

IEC TC 69: Electric road vehicles and electric industrial trucks, prepares international Standards for EV conductive and inductive charging.

Batteries are another building block central to smart mobility and to electrical energy storage.


Water and waste management

As more and more people move to urban areas, the demands on water supply as well as on waste water and solid waste management are bound to increase significantly.

Fresh water supply is heavily dependent on electrical systems, from the pumps needed to extract water and send it to mains water networks to purifying installations required to ensure that water is safe to consume. Increasingly, water supply systems are connected to IT networks and can be operated from remote sites.

Likewise, waste water treatment is becoming highly automated and relies on electrical equipment such as pumps, rotating motors for clarifiers and aeration tanks.

Solid waste management depends on many electrical systems and machinery such as conveyor belts, which, like equipment for fresh water supply and waste water treatment, rely on rotating motors. IEC TC 2 prepares International Standards for the rotating machinery used in all these processes.

Cybersecurity

An important aspect of smart cities (and smart buildings) that needs particular attention is the protection of their multiple systems against cyber-attacks.

Since most, if not all, systems making up smart city environments are IT-based and connected, they can be the target of cyberattacks aimed at either disrupting certain systems or shutting them down completely, which could have catastrophic consequences.

The IEC has been closely involved in the development of Standards for cybersecurity for years through its work in ISO/IEC JTC 1/SC 27: IT security techniques.

The creation of two special bodies illustrates the importance the IEC attaches to cybersecurity:

- The IEC Standardization Management Board (SMB) has set up an Advisory Committee on Information security and data privacy (ACSEC) to deal “with information security and data privacy matters which are not specific to one single technical committee of the IEC” and other tasks.
- The IEC Conformity Assessment Board (CAB) has set up Working Group (WG) 17 and IECEE has established a Policy and Strategy (PSC) WG, both focusing on cybersecurity.

The IoT presents particular cybersecurity challenges as “a single vulnerable device can leave an entire ecosystem open to attack, with potential disruptions ranging from individual privacy breaches to massive breakdowns of public systems”, according to a recent report by the global professional services network Deloitte.

A tale of many TCs

Many more International Standards for all the Smart Grid and Smart Cities building blocks are being prepared by dozens of IEC Technical Committees and their Subcommittees, allowing the development of tailor-made solutions.

In addition to these, aware of the crucial importance of Smart Cities for the future, the SMB has launched a Systems Evaluation Group, SEG 1 on Smart Cities. It is currently preparing a reference architecture and standardization roadmap in cooperation with different organizations. It is looking at liaisons both within and outside the IEC. This includes groups such as ISO/IEC JTC1, ISO, ITU-T (International Telecommunication Union Telecommunication Standardization Sector) and more.

Some 180 experts are active in SEG 1, its 8 Working Groups – which look at issues linked to city service continuity, urban planning and simulation system, city facilities management, use cases, smart cities assessment, standards development for smart cities – and its 3 Task Groups. SEG 1 is set to be converted into a SyC (Systems Committee) later this year.

In addition to this work, the IEC Market Strategy Board (MSB), which brings together Chief Technology Officers of leading international companies, led the preparation of the White Paper on Smart Cities: “Orchestrating infrastructure for sustainable Smart Cities”.

All this work by multiple IEC TCs, IEC SEG 1 and other groups will help the development of Smart Cities.
Common Data Dictionary helps drive business forwards

The IEC CDD facilitates the exchange of technical data between companies

Morand Fachot
As business processes in electrical/electronic industries are increasingly being conducted electronically for both internal processes and interaction with external partners, the use of common concepts is essential to support the required exchange of information. To achieve this, the IEC has developed a Common Data Dictionary (CDD).

Extensive scope
The IEC CDD is a common repository of concepts for all electrotechnical domains. It is based on the methodology and the information model of the IEC 61360 series of International Standards for data element types with an associated classification scheme for electrical items and components.

The database, IEC 61360-4:2005, IEC reference collection of standard data element types and component classes, is freely accessible from the IEC Webstore.

IEC Subcommittee (SC) 3D: Product properties and classes and their identification, developed the CDD and other publications that support its scope. It provides:
- unambiguous identification of classes and properties, and their relationship
- commonly accepted terminology and definitions based on accepted sources such as IEC International Standards, other International Standards, industry standards or those from public authorities
- hierarchies of concepts enabling users to characterize their products and services appropriately
- conditions and constraints providing background information and side-conditions on values of characteristics
- technical representation of concepts including units and data types and their identification

Error-free information sharing and other benefits
The CDD covers concepts specified on a global basis, which support error-free information sharing. In addition, its “dictionaries of concepts may be used as reference collections for setting up master data repositories for product data that serve as company internal information backbones. Thus, costly interpretation and conversion errors may be minimized”.

A significant benefit of the CDD is that it offers language variants (it currently has templates for English, French, German and Japanese). Another benefit lies in its data exchange format and export facilities that use spreadsheet format.

Business processes require increased sharing and exchange of product data among organizations. Technical master data, the reference data set dedicated primarily to technical purposes, but excluding data used in business administration, is central to technical information sharing. To be effective it requires a common worldwide interpretation of master data; i.e. a common syntax, common semantics, and common processes and procedures for standardization.

Errors caused by master data problems can be very costly for companies, requiring correction efforts and resulting in delays and unnecessary extra costs.

Seamless integration
Business processes call for increased sharing and exchange of product data among organizations so that products integrate seamlessly into inventory and administrative software tools. Therefore, customers request products plus ready-to-use data sheets.
The CDD makes this exchange possible. Export facilities of IEC CDD data in a spreadsheet form are explained in the IEC 62656 series for the standardized product ontology register and transfer by spreadsheets.

The software of IEC CDD is maintained and improved by the IEC Central Office IT Department, with IEC Technical Committees (TCs) and SCs continuously expanding its content. The current version of the CDD supports the following features:

- version control, maintained for each entity (class, property, enumeration, document), with the possibility of saving current, new and revised versions, and of consulting version history
- language variants, with language-sensitive fields for preferred, synonymous and short names, definition, notes, remarks and value meaning
- export facilities (Excel)
- bulk upload of proposed items
- automated quality checks on proposals

The data exchange format provided in IEC 62656 does not require specialist software for access to classes, properties, value lists and terminology but can use tools such as MS Internet Explorer and Excel.

Eliminating limits of dialects or language variants
The database was developed by IEC SC 3D. Its Secretary, Reinhard Nerke, outlined some of its characteristics for e-tech. Among other things, he says, the CDD:

- provides semantics for machine-to-machine communication
- avoids misunderstandings and non-conformance costs resulting from voids in common understanding
- complements the work of Electropedia, the IEC online electrical and electronic terminology database, in the field of machine-to-machine communication
- sets up the basis for successful communication between applications internally and externally
- introduces new types of standards, namely database-centric standards that primarily address machines (i.e. software applications that control the machines or help humans managing machines)

Nerke notes that “for machine to machine communication, the IEC CDD has the same potential as the ‘Encyclopædia Britannica’ had for the English language. By providing an accepted reference the door is open for efforts such as the Industrie 4.0 suite of standards and other applications where cooperation is a key issue”.

Threats lurking on medical electronic data
Cyberattacks on healthcare establishments are a growing threat

Over the years the healthcare sector has become increasingly reliant on an IT infrastructure for the proper and safe operation of its equipment and to manage patients’ medical records. Healthcare establishments, long spared cyberattacks aimed at stealing confidential information, are now facing unprecedented attempts to breach into their IT infrastructure. The IEC has been developing means to protect the integrity of IT systems and equipment in the healthcare environment for many years.

Not so recent form of criminal activity
State and non-state actors as well as criminals have been actively targeting institutional IT systems and individuals for many years.

Targets of such attacks aimed at embezzling money or accessing confidential information have been primarily government agencies, financial services, media companies, manufacturers or retailers. The black market demand and prices for information, such as credit card or bank details, email addresses and other information useful in targeting individuals, companies and governments, are high.

The financial losses for affected parties may run into millions of dollars whilst the risks for wrongdoers are minimal.
Targeting new territories
The healthcare sector has been increasingly reliant on IT systems for years, with medical equipment dependent on software to operate more efficiently and reliably.

IEC Technical Committee (TC) 62: Electrical equipment in medical practice, and its Subcommittees (SCs), develop International Standards for electrical equipment, electrical systems and software used in healthcare.

The TC’s remit is to focus on safety and performance (e.g. data security, data integrity and data privacy), among other aspects.

In addition to equipment, systems and software, the healthcare sector in many countries has been gradually transferring patients’ details and history from paper or other supports (like films for X-rays) onto electronic files. This makes for easier processing, billing and archiving and gives medical practitioners easier access to patients’ records when needed.

Unlike other industries such as finance many healthcare organizations have not invested sufficiently in robust IT security measures that can protect and encrypt data in systems, databases, connected devices and personal devices.

Criminals have seized on the inadequately protected IT infrastructures of many healthcare organizations to target these, realizing that the trove of information held by the healthcare industry was considerable and very valuable.

Recent developments show the seriousness of the problem. In February 2015, Anthem the second-largest US health insurance provider, announced that its database had been hacked, exposing personal data on some 80 million personal records.

In March 2015, US health insurer Premera Blue Cross revealed that it had been victim of a large data breach that might have exposed 11 million customers’ medical and financial data.

Between 2010 and 2014, approximately 37 million healthcare records were compromised in data breaches in the US, but in the first 7 months of 2015 alone, more than 105 million healthcare records had already been exposed through 153 separate attacks, according to the US Identity Theft Resource Center (ITRC).

What’s the point?
At first sight one might wonder which benefit could be gained from accessing millions of medical records.

The answer is simple: the data compromised does not contain medical history only, which would be serious enough, but also personal information such as dates of birth, social security and bank account numbers and other details, which can be misused for identity theft or other illegal schemes.

The value placed on such information is reflected in the fact that it is now worth much more on the black market than financial details. More worryingly, according to cyber security strategy advisor J-B Rambaud, healthcare data can be used to steal the identities of children, who have clean credit records and are unlikely to uncover the fraud, or for extortion of celebrities or politicians hiding an illness.

More potential risks looming
As the attractiveness for wearable health monitoring and tracking devices and apps soars, some healthcare providers start offering patients the possibility of transmitting data to and from their health files.

The technology and the devices are relatively new and offer many benefits, but the data security implications are yet to be fully assessed. However it is likely that these will result in new challenges to protect patients’ health records from access by unauthorized parties.

IEC standardization thwarting data security threats in healthcare
If attempts to gain access to electronic medical records through cyberattacks are relatively recent, awareness of the need to protect data security, integrity and privacy of medical electrical equipment has been central to the work of IEC TC 62 and, in particular,
of IEC SC 62A: Common aspects of electrical equipment used in medical practice.

IEC 62A has issued International Standards and Technical Reports that cover medical device software and IT networks incorporating medical devices.

In addition to data security-related work carried out by SC 62A, significant international standardization in the field of IT security techniques at a general level is carried out by ISO/IEC JTC 1/SC 27, a SC of the Joint Technical Committee (JTC) set up by the IEC and the International Organization for Standardization (ISO) to work on International Standards for information technology.

The importance the IEC attaches to cybersecurity was further highlighted by the decisions taken last year to create new entities.

IEC Standardization Management Board (SMB) agreed to set up a new Advisory Committee on Security (ACSEC) at the 2014 IEC General Meeting. Its scope includes dealing with information security and data privacy matters which are not specific to a single IEC TC; coordinating activities related to information security and data privacy; providing guidance to TC/SCs for implementation of information security and data privacy in a general perspective and for specific sectors. ACSEC held its first meeting in May 2015.

IEC Conformity Assessment Board (CAB) set up Working Group (WG) 17 and IECEE established a Policy and Strategy (PSC) WG, both focusing on cybersecurity.

These entities and specific publications on IT security techniques and data protection by ISO/IEC JTC 1/SC 27 and IEC 62A will contribute significantly to enhancing data security for the medical environment in the future.

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**Enhancing how you see the world**

How new sectors are embracing innovative ways to use augmented reality

**Antoinette Price**

Have you experienced augmented reality (AR)? If you have ever had keyhole surgery, reached your destination by using a satellite navigation system or used an AR catalogue to see how furniture looks in your home before buying it, the answer is yes.

Like many cutting-edge technologies, the scope for AR applications is broad, encompassing sectors as diverse as education, entertainment and gaming, manufacturing, marketing and advertising, medical, military, navigation and tourism. It continues to expand rapidly, but the industry faces important challenges it will have to overcome if AR technology is to become mainstream.

**Mobile communication boosts AR**

Figures from eMarketer show that two billion consumers worldwide are expected to be using smart phones by 2016 and over half of mobile phone users globally will have smartphones in 2018. Riding this trend, consumer adoption of AR is expanding thanks to wider brand and retailer engagement through mobile channels, now considered by a number of companies to be a primary communications medium for customers.

A report by Juniper Research estimates that annual revenues from mobile AR...
services and applications will reach USD 1.2 billion in 2015. While games accounted for 40% of AR downloads in 2013, the report predicts that mainstream lifestyle, enterprise and general entertainment applications using AR should achieve annual mobile revenues in excess of USD 1 billion within five to six years. The report also highlights the potential for AR app usage with smart wearables such as smart glasses, and forecasts that AR app user numbers will be approaching 200 million by 2018.

Layering technology
So how does AR technology work? It enhances reality by overlaying the user’s field of vision with supplementary digital information in real time, usually by means of computer-generated graphics. For example, when a tennis player queries a serve, TV viewers see a line which follows the ball to show whether it was in or out.

The key to this technology lies in the software. Special 3D augmented reality programmes allow the developer to link animation or contextual digital information in the computer programme with an AR “marker” in the real world.

Standardization ensures that manufacturers, companies and users can produce, sell and use reliable, safe products and services. Several IEC Technical Committees (TCs) and Subcommittees (SCs) prepare International Standards for AR applications and for the technology that enables them.

ISO/IEC JTC1/SC 29: Coding of audio, picture, multi-media and hypermedia information, has published ISO/IEC 23000-13, Information technology - Multimedia application format (MPEG-A) – Part 13: Augmented reality application format. It focuses on the data formats used to provide an AR presentation and is designed to enable the use of 2D/3D multimedia content.

This Standard specifies:
- scene description elements for representing AR content
- mechanisms to connect to local and remote sensors and actuators
- mechanisms to integrate compressed media (image, audio, video, graphics)
- mechanisms to connect to remote resources such as maps and compressed media

It’s all done with sensors
Microelectromechanical systems (MEMS) sensors can be found in everything from automobiles, PCs, medical devices and industrial applications to – more recently – portable consumer electronics. This is due to a reduction in their cost, size and power consumption. MEMS, which detect the orientation of a device, the direction in which it is moving and its absolute location in three dimensional space, are a key part of the technology required for location-based services using AR applications. Some examples of MEMS are health and fitness monitors, gaming or tracking systems.

IEC SC 47E: Discrete semiconductor devices, and IEC SC 47F: Microelectromechanical systems, prepare a number of International Standards that enable manufacturers to build better, more efficient and reliable sensors and MEMS. Together they facilitate the design, manufacture, use and reuse of MEMS.

Innovative AR apps for medical and healthcare
Augmented reality is transforming the medical and healthcare sectors significantly for patients, doctors and pharmacy management alike.

AR apps can be very useful for teaching anatomy and surgical procedures, by overlaying digital information in the form of video, audio or 3D models onto human skeletons using head mounted displays. For example, projecting a CT scan onto a patient gives doctors an “X-ray” vision of patients can provide key contextual cues for diagnosing patients and learning.

Seeing is understanding with the EyeDecide app. Designed as a patient engagement package, the AR app
educates patients as well as improving their care management. It enables sharing customized care plans and treatments and uses interactive 3D animation, text description, and radiographic imagery to explain the most common eye conditions and procedures to patients. They are then more informed when it comes to deciding about their care thanks to images and anatomical layers used to demonstrate disease progression. There personal information is easily uploaded and shared, which improves care quality and saves consultation time.

Some patients who take medication regularly sometimes forget to do so. Users of wearables such as Google Glass can install an app which allows them to receive reminders of when to take their medication.

According to the National Parkinson Foundation, Parkinson’s is the second most common neurodegenerative disease after Alzheimer’s, affecting an estimated four million worldwide. An AR app has been developed to help sufferers of this movement disorder, which affects the nerve cells and makes it impossible to move. By combining dance with a Google Glass AR app, patients can improve body balance, do seated routines in the mornings and evenings and standing routines for when they suddenly freeze in mid walk, to get moving again. By tapping the glasses or speaking, users receive a walking speed which is set by visual stimulation and music. The app provides a portable, intuitive interface offering real-time, on demand assistance.

Other apps have been developed for people with mental health issues. Empathear helps families and others understand schizophrenia better. Smart phone microphones pick up the user’s surroundings and, in conjunction with mood settings, sounds and whispers, enable users to gain an improved understanding of how sufferers feel, depending on their mood and external environment.

PTSD Coach, an app for veterans and military service members with post-traumatic stress disorder, provides education about the condition and information about professional care, self-assessment, support and tools for managing daily stresses.

Who else is augmenting reality?
The gaming and military sectors have long used AR applications, however others are finding innovative and creative ways to apply this technology including:

Retail: a number of high-street and high-end brands have created an array of interactive AR apps for their products, such as an AR dressing room, which allows shoppers to try on their clothes virtually or an AR makeup mirror (photo) that lets customers see which make-up shades suit their skin tones before purchasing them. A well-known global furniture company has launched an AR catalogue that enables customers to ‘place’ the piece of furniture in their homes with an app that then measures the size of products relative to the surrounding room.

Location-based services: several similar apps have been developed in different countries. They allow users to point their phones at buildings as they walk along a street and receive information about restaurants and other sites in the area, such as write-ups of various businesses that have registered with the app. This type of service has boomed with the increased use of smart phones, since it only requires a camera, a global positioning system (GPS) and an Internet connection in order to receive information in real time.

Automotive: as a means of keeping drivers looking ahead rather than down if they need to access additional information, car manufacturers are considering integrating AR features into the next generation of head-up displays (HUDs). HUDs present virtual images that are focused beyond the instrument panel and appear to be superimposed on the driver’s view of the road ahead. However, there is increasing concern that this could be too distracting and compromise safety when drivers shift their focus from the road to reading information displayed on the windscreen. More testing is needed before this technology becomes widely available.
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Not so new
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Manufacturing: AR applications are improving product design by allowing manufacturers to experiment with possible scenarios before they make parts. Virtual objects may be shown attached to products so as to convey how each part is to be assembled or disassembled. Text instructions or video clips can show a procedure by referencing specific points or objects along the way. Such explanations, delivered in real time, reduce worker fatigue and errors and improve quality and delivery time. AR applications are also used for machining and robot operational planning and for assembly, shop floor layout, maintenance and for teaching and implementing manufacturing procedures.

Mining: an Australian company has introduced one of the first AR applications for mining, allowing operators to use handheld devices for conformance in the field. A laser scanner collects surface data as mining happens. The app then automatically registers this data against the 3D design of mine plans which have been imported previously and are used for comparison. This takes under 10 minutes on a smartphone, tablet or laptop.

Medical biometrics improve patients’ care
How the healthcare sector benefits from advances in medical biometrics

Jody Tarshis, IHS
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technologies, particularly wearable devices, allows medical personnel to monitor patients biometric data remotely, exchange information with colleagues and develop data sets for research.

A 2015 IHS study singles out wearable and mobile biometric technologies as significant growth areas. IHS projects that revenue for health and medical applications from wearable technology alone will reach USD 8.7 billion by 2019. Wearables will evolve into sophisticated multi-function devices.

Collecting, transmitting and protecting medical data
Enabling data capture and interchange from medical devices is an essential function of medical biometrics. Devices have internal software to manage internal functions, but the data is useless unless it can be transmitted and received. Existing International Standards developed by ISO/IEC Joint Technical Committee (JTC) 1: Information Technology, or standards prepared by the American National Standards Institute (ANSI) or the InterNational Committee for Information Technology Standards (INCITS) specify data interchange formats, technical interfaces and application profile, among other others.

Medical information is as vulnerable to hackers and fraudsters as any other digitized data – whether it is transmitted wirelessly or stored on a computer (see article in this e-tech on cyberthreats to medical data). The Data Center Journal points out the much higher rate of cyberattacks on healthcare insurers and providers. Since this information is highly personal, stolen data can be used for identity theft and other crimes. Despite rigorous precautions and governmental directives, medical data is not secure, as demonstrated by recent major hacks of US healthcare providers.

Importance of Standards in medical biometrics
Adherence to national and International Standards for data capture and interchange allows devices to transmit and receive biometric data without regard to equipment, national boundaries, or languages.

The use of standards satisfies national and/or international security and privacy requirements. More and more countries demand that healthcare providers meet strict requirements for medical records privacy. This is the case with the Health Insurance Portability and Accountability Act (HIPAA) in the US. Some problems linked to privacy may emerge too. This was the case in the UK where the National Health Service (NHS) Programme for IT, launched in 2002, was scrapped in 2011 because, among other things, of concerns over the privacy of patients’ medical records.

Companies that plan to do business outside their home countries need to understand and comply with local regulations, as well as with national and international standards.

General adherence to standards also eliminates problems related to the deployment of proprietary software that does not communicate with other products. Widespread use of standards therefore promotes simplified collaboration and communication between doctors and patients, as well as between colleagues at different institutions.

Development prospects
Biometric data other than fingerprints or iris scans might be usable for secure personal identification. An example is the ECG data mentioned above. Other techniques combining ECG and other types of data are being developed to protect an individual’s personal records.

Another novel use of biometric data is a surgical navigation system, Scopis, with touchless control, which enables a surgeon to plan a procedure in real time, on a computerized model, before making any incisions.

Healthcare providers increasingly rely on patient-generated data, collected from wearable devices and transmitted via smartphone or tablet. Growth in development of digital health-tracking platforms such as Validic and Apple Health Kit, will fuel continued innovation in personal healthcare development.
Finding the right Standards for Smart Grids

The IEC developed tools to help find the right International Standards for Smart Grid with minimal trouble.

Morand Fachot

Smart Grids are seen as a necessary solution to overcome issues such as aging grid infrastructures, constantly expanding energy demand and the integration of a growing share of intermittent renewables into power networks. Smart Grids require a multitude of International Standards to ensure the various building blocks that cover all key areas are interoperable. The search for the right International Standards is made easier with IEC tools.

Mapping Tool

Most International Standards needed for Smart Grids are developed by the IEC, a number are prepared also with other Standards Development Organizations (SDOs) or are compatible with their standards or recommendations.

The IEC has created a Smart Grid Standards Map that allows the quick identification of the relevant Standards. This Map gives an architecture view and a mapping view that show the relationship between International Standards and Smart Grid components.

It includes 16 clusters of components, such as automated metering infrastructure, commercial home automation, communication infrastructure, distributed energy, or distribution automation devices, which form the generic Smart Grid landscape. It also lists use cases. Clicking on a component or a use case opens a drop-down list of relevant standards, and hovering over a Standard gives its description.

In addition to the architecture view the mapping view shows a components/cluster view on the left side and a Standards view on the right side. The former gives a list of all the standards that are associated with a specific cluster/component, the latter a list of Standards arranged by number, with IEC Standards listed first.

This Mapping Tool makes it possible to identify quickly any given Standard in relation to its role within the Smart Grid.

Easily identifiable Smart Grid-relevant Standards

Some 300 IEC International Standards have been identified as relevant to Smart Grid infrastructures. They include so-called core Standards as well as Standards whose relevance to Smart Grid is seen as being high, medium or low.

A complete list of these International Standards by importance and relevant application, is available for download from the IEC Smart Grid website pages.

In addition to the degree of relevance, the list indicates the topic concerned, e.g. telecontrol, power lines, solar photovoltaic, wind power, electromagnetic compatibility (EMC) or distribution management. It also gives the relevant areas, e.g. distribution automation (DA), distributed energy resources (DER), advanced meter infrastructure (AMI), communication, storage or smart homes.

With its Smart Grid and smart electrification webpages, its list of Smart Grid-relevant Standards, the IEC provides the necessary background information and quick access to the relevant Standards to all utilities, companies and individuals involved in Smart Grids.
INDUSTRY SPOTLIGHT

Keeping the body shipshape

Healthcare has been relying on electrical systems for decades, recent advances will amplify this trend

Morand Fachot

Treatment of patients has been greatly improving for decades, thanks to a great extent to the introduction of new medical electrical equipment and systems, and improvement on existing ones. In addition to well-established domains such as medical imagery, acoustics or ultrasonics, which have benefitted from significant advances over the years, more electrotechnologies, some very recent, are finding their way in healthcare heralding more progress in the future.

Continuing improvements in well-established domains

Medical imaging, used to visualize the interior of patients’ bodies, is an indispensable tool that allows doctors to diagnose and treat internal illnesses and traumatic injuries, such as fractures. It benefits from continuous advances that improve its capabilities.

Medical imaging uses 5 main groups of systems, each segmented in subcategories aimed at reaching the right diagnosis. They are:

- X-ray imaging uses a form of electromagnetic radiation, whose properties were discovered by German physicist Wilhelm Röntgen in 1895
- Computed tomography (CT), relies on X-ray images that are processed by a computer to produce tomographic images or “slices” to obtain three dimensional views of internal organs
- Ultrasound uses high frequency sound waves to produce images, viewed on a screen, of internal organs, vessels and tissues
- Magnetic resonance imaging (MRI) uses magnetic fields produced using magnets and radio waves to generate images of the body
- Nuclear imaging technologies are also used for tomography

These systems rely on International Standards prepared by a number of IEC Technical Committees (TCs) and Subcommittees (SCs).

The remit of IEC TC 62: Electrical equipment in medical practice, and its SCs, is to “prepare International Standards and other publications concerning electrical equipment, electrical systems and software used in healthcare and their effects on patients, operators, other persons and the environment”.

The task of IEC SC 62B: Diagnostic imaging equipment, is “to prepare international publications for safety and performance for all kind of medical diagnostic imaging equipment, such as X-ray, CT and MRI imaging equipment).

The work of IEC SC 62C: Equipment for radiotherapy, nuclear medicine and radiation dosimetry, includes the preparation of “Standards for the safety and performance of (…) nuclear medicine equipment used for imaging”.

As for IEC TC 87: Ultrasonics, it prepares International Standards for equipment and systems in the domain of ultrasonics, primarily in the medical domain. In addition to imaging this includes also applications in non- and minimally-invasive therapy, like bone and ligament healing, and physiotherapy for inflammation; drug distribution to treat tumours; and cosmetic applications, such as non-

New needs, new treatments, new technologies

Many electrotechnologies, not directly related to medical applications, find their way into healthcare, either opening up new opportunities or leading to improvements in existing electrical medical equipment and systems, and to a wide variety of treatments.

One such promising technological application is medical robotics, which

This 3D-printed skull was implanted on a 22-year old woman in a life-saving operation in the Netherlands (Photo: University Medical Center Utrecht)
concerns mainly surgery. Medical robots have made laparoscopic surgery, also known as minimally-invasive surgery (MIS), even less invasive and have extended their use beyond the initial main applications of gall bladder and prostate removal, gastrointestinal and gynaecological surgery and urology. Robots are now used for more complex operations in cardiothoracic, orthopaedic and general surgery, and for internal radiation therapy.

As medical robotics is a relatively new domain, the preparation of International Standards for it is emerging as a priority.

To carry out this work IEC SC 62A: Common aspects of electrical equipment used in medical practice, formed Joint Working Group (JWG) 9 with ISO TC 184/SC 2 in June 2011. More than 80 experts are currently active in SC 62A/JWG 9, reflecting the importance of standardization for the sector.

Print those parts and those circuits

Printing prototypes and parts has been around for a while. Mostly known as 3D printing or fast prototyping, it has seen the widest range of actual applications in modern medicine, where it has been described as a game-changer. It has been used to help surgeons prepare for difficult operations, such as cardiac surgery, or the separation of conjoined twins. After gathering information using X-rays, MRI and CT scans, a specialized company prepares medical anatomical models using 3D printing to help surgeons plan and rehearse operations.

Other 3D printing medical applications include bioprinting of skin for transplant, reconstructive surgery, making customized dental implants, joint replacements and medical devices, such as hearing aids. These result in faster recovery times, better functionality and, in the case of hearing aids, smaller, custom-made devices.

Printed electronics, the printing of circuits on rigid or flexible substrates, often merged with 3D printing techniques, also offers interesting medical applications. Examples include printing wearable sensors and monitors for medical and health management applications, or the development of a customized implantable glove-like cardiac monitoring device fitted with tiny printed sensors. IEC TC 119: Printed electronics, established in 2011, develops International Standards for terminology, materials, processes, equipment, products and health/safety/environment in the field of printed electronics.

Make them small and smaller, and smaller

Nanotechnology involves manipulating properties and structures at the atomic scale, is seen as another key future technology in medicine. Nanomedicine, as it has become known, is already being used for new, more effective targeted drug delivery systems, for therapy, diagnosis or cell repair. It is expected to lead to the development of medical nanomachines that will be used in the body. Nanotechnology is in early stages of development, but IEC TC 113 has already developed International Standards for the technologies relevant to electrical and electronic products and systems in the field of nanotechnology.

More electrotechnologies in the medical environment

Many healthcare treatments rely on the use of electrical equipment and systems.

Lasers, for instance, are used in many applications that include bioprinting, ophthalmology and surgery, including brain surgery, as lasers can cut with much greater precision than any scalpel and are additionally capable of fusing tissues together. IEC TC 76: Optical radiation safety and laser equipment, develops International Standards for laser equipment used in healthcare.

Other components, like fibre optic systems and active devices are used in medical sensors. International Standards for such systems and equipment are prepared by IEC TC 86 and its SCs.

These represent a handful only of technologies and applications used in the healthcare environment. All and more rely on IEC International Standards developed by many IEC TCs and their SCs.
No power without communication
Communication between equipment and systems is increasingly important for electric power grids

Morand Fachot
A transition from one-way power distribution structures to two-way grids, where information is exchanged in both directions between producers and consumers, is taking place. This change to Smart Grids requires the incorporation of interoperable equipment and systems for controlling the electric power process into integrated systems and solutions. IEC Technical Committee (TC) 57: Power system management and associated information exchange, develops International Standards that are critical to this integration.

Evolving role over 50 years
IEC TC 57 was established in 1964 to meet an urgent need to produce International Standards in the field of communications between the equipment and systems for the electric power process, including telecontrol, teleprotection and all other telecommunications to control the electric power system. Its scope and titles were changed in 1994 and 2003 to take into account system aspects in addition to equipment aspects and changes in power systems management.

Power systems management comprises control within control centres, substations and individual pieces of primary equipment including telecontrol and interfaces to equipment, systems and databases, some of which may be outside the scope of TC 57.

Comprehensive remit
The role of IEC TC 57, as outlined in its scope, is “to prepare international standards for power systems control equipment and systems including Energy Management Systems (EMS), Supervisory Control and Data Acquisition (SCADA), distribution automation, teleprotection, and associated information exchange for real-time and non-real-time information, used in the planning, operation and maintenance of power systems.”

The scope also stresses that the special conditions in a high voltage (HV) environment have to be taken into consideration.

It also notes that International Standards developed by other IEC TCs as well as other standards and recommendations prepared by organizations like the International Organization for Standardization (ISO) and the International Telecommunication Union (ITU) “shall be used where applicable, as far as these standards or specifications fit consistently to TC 57 communication architecture.”

Extensive structure and participation
To cover its very broad remit TC 57, which brings together 31 participating and 15 observer countries, set up the following 12 Working Groups (WGs):

- WG 03: Telecontrol protocols
- WG 09: Distribution automation using distribution line carrier systems
- WG 10: Power system Intelligent Electronic Device (IED) communication and associated data models
- WG 13: Energy management system application program interface (EMS - API)
- WG 14: System interfaces for distribution management (SIDM)
- WG 15: Data and communication security
- WG 16: Deregulated energy market communications
- WG 17: Communications systems for distributed energy resources (DER)
- WG 18: Hydroelectric power plants – Communication for monitoring and control

TC 57 develops Standards for the transmission of data through power lines
• WG 19: Interoperability within TC 57 on long term
• WG 20: Planning of (single-sideband) power line carrier systems
• WG 21: Interfaces and protocol profiles relevant to systems connected to the electrical grid

Work by three of these WGs: WG 10, WG 17 and WG 20, is of particular relevance to Smart Grid applications.

TC 57 also set up AHG 8: IPv6, an ad hoc Group created to look at the use of Internet Protocol version 6 (IPv6) as a network protocol for IEC TC 57 standards.

In addition to these, TC 57 formed two Joint WGs (JWGs): JWG 16, with (and managed by) IEC TC 13: Electrical energy measurement and control, on common information model and data models and message profiles for automatic electricity metering data exchange; and JWG 25, with (and managed by) IEC TC 88: Wind turbines, for communications for monitoring and control of wind power plants.

A very large number of experts, close to 620, are active in TC 57, reflecting the importance and interest the electric power industry attaches to its work.

As of September 2015, TC 57 had issued more than 140 publications, and had nearly 60 projects in development.

**Trends driving standardization work**
Both technology and market trends drive TC 57 standardization work.

Constant and fast developments in information and communication technology (ICT) have a direct impact on the work of TC 57, which needs to follow these developments to seize and integrate solutions to achieve a rapid implementation of Standards.

Interoperability is essential for automated power systems, this applies to communication between utilities and users and requires the adoption of similar technologies on both side, at least in terms of communication systems (protocols, data).

**Two-way traffic involving other IEC TCs**
TC 57 work requires establishing liaisons with a number of other IEC TCs. It is a supplier of Standards to TCs that develop International Standards for measuring equipment, including meters, for HV switchgear and controlgear assemblies, for instrument transformers and for renewable energy sources (hydropower and wind turbines).

TC 57 is also a customer of Standards developed by IEC TC 8: Systems aspects for electrical energy supply, and IEC TC 65: Industrial-process measurement, control and automation.

In addition TC 57 maintains liaisons with other IEC TCs that have degree of connection with Smart Grid issues, like IEC TC 69: Electric road vehicles and electric industrial trucks, Project Committee (PC) 118: Smart grid user interface, IEC TC 120: Electrical Energy Storage (EES) Systems.

As new types of grids that rely increasingly on the exchange of information are being introduced in many countries, International Standards developed by IEC TC 57 will play a critical role in the rollout of future power supply and distribution infrastructures.
Always safer medical electrical equipment

IEC standardization work ensures medical electrical equipment and systems are safe to use and operate

Morand Fachot
Medical care rests on trust. Trust between patients and medical staff and trust of the latter the equipment they use for examining and treating patients. IEC International Standards are developed specifically to ensure medical electrical equipment and systems are safe to operate, for the well-being of patients and users alike.

Coordinating role
IEC TC 62 has four SCs that deal with distinctive domains and issue all its publications. TC 62 has delegated to its SCs the task of developing standards.

The preparation of International Standards for the design and production of medical electrical equipment requires the participation of many experts from the medical professions, industry, healthcare establishments, the IT (information technology) and software worlds and regulatory bodies.

As electrical equipment and systems in medical practice use a wide range of components, TC 62 International Standards and those of its SCs also refer to and use International Standards from many other IEC TCs and SCs. This means that TC 62 is not only a customer of, but also a supplier to, other IEC and ISO (International Organization for Standardization) TCs. As a result, the safety of medical electrical equipment is an inclusive process that includes work carried out by nearly two dozen other IEC TCs.

Four subcommittees are involved in the preparation of standards for this type of equipment. They deal with common and specific aspects of standardization work for different types of equipment.

Common aspects
SC 62A covers common aspects of electrical equipment used in medical practice. It has two Working Groups (WGs), 10 Maintenance Teams (MTs) and has set up a total of nine Joint Working Groups (JWGs) with ISO.

With the (fairly recent) introduction of ICT (information and communication technologies) applications to the medical domain, the scope of the SC’s work has expanded significantly with the integration of medical devices into IT networks. SC 62A formed JWG 7 with ISO to work on the first standard addressing both networks and medical devices.

As robots are now present in the medical environment, SC 62A set up JWG 9: Medical electrical equipment and systems using robotic technology. Its task is to “develop general requirements and guidance related to the safety of medical electrical equipment and systems that utilize robotic technology.” As of July 2015 IEC SC 62A had issued more than 50 publications.

Specific areas
SC 62B prepares international publications for the safety and performance of all kind of medical diagnostic imaging equipment such as X-ray, computed tomography (CT), magnetic resonance imaging (MRI) equipment, including related associated accessories and systems. TC 62B also works on the development of related terminology, concepts, terms and definitions. It has 2 WGs, 13 MTs and set up a JWG with an ISO SC.

As of July 2015, IEC SC 62B had issued more than 60 publications.

Morand Fachot
Medical care rests on trust. Trust between patients and medical staff and trust of the latter the equipment they use for examining and treating patients. IEC International Standards are developed specifically to ensure medical electrical equipment and systems are safe to operate, for the well-being of patients and users alike.

Coordinating role
IEC TC 62 has four SCs that deal with distinctive domains and issue all its publications. TC 62 has delegated to its SCs the task of developing standards.

The preparation of International Standards for the design and production of medical electrical equipment requires the participation of many experts from the medical professions, industry, healthcare establishments, the IT (information technology) and software worlds and regulatory bodies.

As electrical equipment and systems in medical practice use a wide range of components, TC 62 International Standards and those of its SCs also refer to and use International Standards from many other IEC TCs and SCs. This means that TC 62 is not only a customer of, but also a supplier to, other IEC and ISO (International Organization for Standardization) TCs. As a result, the safety of medical electrical equipment is an inclusive process that includes work carried out by nearly two dozen other IEC TCs.

Four subcommittees are involved in the preparation of standards for this type of equipment. They deal with common and specific aspects of standardization work for different types of equipment.

Common aspects
SC 62A covers common aspects of electrical equipment used in medical practice. It has two Working Groups (WGs), 10 Maintenance Teams (MTs) and has set up a total of nine Joint Working Groups (JWGs) with ISO.

With the (fairly recent) introduction of ICT (information and communication technologies) applications to the medical domain, the scope of the SC’s work has expanded significantly with the integration of medical devices into IT networks. SC 62A formed JWG 7 with ISO to work on the first standard addressing both networks and medical devices.

As robots are now present in the medical environment, SC 62A set up JWG 9: Medical electrical equipment and systems using robotic technology. Its task is to “develop general requirements and guidance related to the safety of medical electrical equipment and systems that utilize robotic technology.” As of July 2015 IEC SC 62A had issued more than 50 publications.

Specific areas
SC 62B prepares international publications for the safety and performance of all kind of medical diagnostic imaging equipment such as X-ray, computed tomography (CT), magnetic resonance imaging (MRI) equipment, including related associated accessories and systems. TC 62B also works on the development of related terminology, concepts, terms and definitions. It has 2 WGs, 13 MTs and set up a JWG with an ISO SC.

As of July 2015, IEC SC 62B had issued more than 60 publications.

Medical imagery has made great progress thanks to equipment such as this MRI scanner (Photo: Siemens)
SC 62C covers equipment for radiotherapy, nuclear medicine and radiation dosimetry. The potential health risks posed by such equipment in terms of its use of high-energy ionizing radiation (in common with some of the diagnostic imaging equipment covered by SC 62B) were not known initially. The illness that killed Nobel Prize-winner Marie Sklodowska-Curie is widely attributed to her long-time exposure at work to ionizing radiation without having taken proper protective measures. Today, the awareness of the risks posed by ionizing radiation and protection against these are high on the list of medical safety priorities. SC 62C has 3 WGs dealing with these areas. As of July 2015 it had issued 39 publications.

SC 62D covers electromedical equipment, equipment used to diagnose and monitor patients, and equipment for treating, or used as an aid in the treatment of, patients. This includes, for instance, haemodialysis, haemodialfiltration and haemofiltration machines, electrocardiographic monitoring equipment or nerve and muscle stimulators.

SC 62D has 2 WGs, 11 MTs and also formed 16 JWGs with ISO SCs to work on a wide range of medical equipment. As of July 2015 it had issued 68 publications.

Supplier to other IEC TCs
Other IEC TCs also refer to and use TC 62 International Standards, notable examples are:

TC 29: Electroacoustics, which standardizes instruments used in the field of electroacoustics and appropriate methods of measurement. It covers audiometric equipment as well as the hearing aids and induction-loop systems used by hearing-impaired people.

TC 64: prepares International Standards concerning electrical installations and protection against electric shock. It uses SC 62A Standards.

TC 76: Optical radiation safety and laser equipment, prepares International Standards for equipment and systems incorporating lasers and LEDs (light emitting diodes). These must meet acceptable levels of laser radiation and exposure to optical radiation that are determined by independent organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the International Commission on Illumination (CIE).

TC 87: Ultrasonics, prepares International Standards related to the characteristics, methods of measurement, safety, and specifications of fields, equipment and systems in the domain of ultrasonics. Excluded from the scope of TC 87 are safety standards for medical electrical equipment (MEE) and systems. Despite its apparent scope, human exposure to ultrasonic fields and the need to determine the performance of medical ultrasonic equipment are at the basis of the work of TC 87. A great deal of its work is therefore oriented towards the ultrasonic aspects of medical equipment.

As TC 62, through its SC 62B, prepares, among other things, International Standards for safety and operation of ultrasound scanners some aspects of its work are of direct relevance to the International Standards prepared by TC 87. Both maintain close liaison in fields of common interest.

Synergies
Electric equipment and systems are present everywhere in the healthcare environment. They use a wide range of often very complex technologies that require many different parts, from cables and connectors to power supplies and more complex components or systems. As a result, many different IEC TCs are involved in the preparation of the variety of International Standards required for the overall safe operation of such equipment.

With greater reliance on technology to treat an aging population in many countries, the use of electrical devices and systems in the medical domain is bound to increase. The work of IEC TC 62 and its SCs will follow a similar trend. The fact that over 1 200 such experts from 27 Participating and 17 Observer countries are represented in TC 62 and its SCs attests to the importance the medical profession and MEE manufacturers attach to the safety of their equipment.
Energy-efficient living
IEC certification targets energy efficiency

Claire Marchand
How many electrical appliances and devices do we rely on in any one day? From the lights that we switch on, to the hair dryer, oven and television at home and the computer in the office, most of the tasks we accomplish require the assistance of electrical devices. And then there are the appliances that run 24 hours a day, seven days a week: refrigerators and heaters, for example.

Aiming for smart and efficient
We are surrounded by electrical equipment but we are always on the lookout for new devices that will lighten the burden of our domestic chores and make life easier. The temptation is even greater today, with the emergence of appliances that are smart, interconnected and energy efficient. We may have twice as many electrical appliances as we had 15 or 20 years ago, and yet our electricity bills are lower.

Huge progress has been made in recent years in the development and manufacture of appliances and equipment that consume much less energy than was the case when energy saving wasn’t a pressing issue. Today’s appliances often consume less than half of the electricity they would have used in the past, despite the new products’ many added features.

Major benefit for the consumer
Improving the energy efficiency of household appliances and equipment saves money, reduces emissions and can also improve productivity. Many countries have developed, or are developing, strategies for energy savings and emissions reduction from appliances and are passing legislation to that effect.

Energy efficiency through IEC standards...
Standards can serve as the basis for regulations and legislation in the energy efficiency field. The IEC has a whole catalogue of International Standards that deal not only with safety requirements for appliances and equipment, but also provide metrics and testing specifications to achieve optimum energy consumption.

Manufacturers of appliances and equipment for domestic use can rely on IEC International Standards to develop state-of-the-art products that meet the strictest safety and energy-efficiency requirements. Going a step further, they can rely on the IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components, to have their products tested and certified.

...and certification
IECEE has been testing and certifying appliances and equipment for many years, focusing on product safety and, when the standards require it, also providing services covering aspects of performance. Several years ago, in response to industry demand, IECEE introduced the product category E3 dedicated to energy efficiency.

It is much easier today to monitor energy consumption on a daily basis.

Our houses are becoming smarter, and so are the appliances we use.
Powder and dust: a risky business
How to protect people and equipment from combustible dusts

Claire Marchand

The dramatic incident at the Formosa Fun Coast, a water park in Taiwan, at the end of June was an extremely tragic but important reminder that dust explosions are real and that any activity that involves the use of powder or dust is potentially hazardous.

A thousand people gathered for a “festival of colour” – Colour Play Asia in Taiwan is said to be the largest in Asia – at the amusement park outside Taipei. As part of the entertainment during the event, coloured powder was sprayed over the party-goers, creating a very dense dust cloud over the stage and in the park area nearby. The powder was repeatedly blown into the air for beautiful special effects...until an explosion occurred. It is believed that the powder was ignited either by a cigarette or by the heat emanating from the powerful spotlights and an immense ball of fire very quickly engulfed the stage and ripped through the crowds, injuring more than 500 participants.

Why did it happen?
A publication by German-based company Stahl explains the mechanisms of a dust explosion:

“If a draft of air swirls up a layer of dust in a small area, the dust, along with oxygen, forms a combustible dust/air mix. If this mix is ignited by an ignition source, an explosion is triggered. The force of the resulting explosion swirls up more dust, which is in turn ignited. This process continues, and under some conditions chain reactions such as these sweep through entire buildings or facilities, destroying them.”

Many materials can become combustible under specific situations. Examples include:

- agricultural products such as egg whites, powdered milk, corn starch, sugar, flour, grain, potato, rice, etc.
- metals such as aluminium, bronze, magnesium, zinc, etc.
- chemical dusts such as coal, sulphur, etc.
- pharmaceuticals
- pesticides
- rubber
- wood
- textiles
- plastics

In the Taiwan incident, the powder sprayed during the party was said to be corn starch.

A major risk factor
The large majority of industrial dusts are combustible, and dust explosions can occur in any enclosed area. Dust explosions are a frequent occurrence...
in underground coal mines, but they can happen in any location where powdered combustible material is present.

Even an extremely thin dust layer in a closed room is sufficient to trigger an explosion when the dust is swirled up and ignited.

Ignition sources for dusts include sparks from electrical or mechanical processes, arcs, open flames, ESD (electrostatic discharge), and electromagnetic waves among others.

**Safe manufacturing processes**
Because of the hazards associated with the presence of dusts, all equipment – electric cables and motors, enclosures, isolators and vents, lamps and switches, control systems and many, many more – used in manufacturing processes should have the relevant level of dust explosion protection. Failure to do so can result in major industrial accidents and have fatal consequences.

Through its standardization and conformity assessment work, the IEC has a solution for all sectors of industry that are operating in those hazardous environments. The Commission has been at the forefront of Ex standardization for many years, preparing International Standards and establishing a Conformity Assessment (CA) System that provides testing and certification for all types of Ex equipment and related services as well as personnel competence.

**Specific requirements for explosive atmospheres**
IEC Technical Committee (TC) 31: Equipment for explosive atmospheres, has a complete series of International Standards, IEC 60079, that cover all specific requirements for Ex equipment and systems, from general requirements to protection levels for apparatus used by all sectors that operate in hazardous environments, such as food processing, pharmaceuticals, sugar refineries, flour mills, grain silos as well as the paper and textile sectors.

TC 31 has also developed the IEC 61241 series of International Standards that focuses on electrical equipment in the presence of combustible dust.

**How to ensure compliance and safety**
To make sure that the equipment they purchase meets the very strict requirements specified in the IEC 60079 series of International Standards, as well as those put in place by national or regional regulations and legislation, the Ex industry can rely on IECEx, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres for testing and certification.

An IECEx certificate provides clear proof of compliance with International Standards, an important assurance for anyone responsible for the safety of those working in such areas.

**High level of safety for Ex workforce**
To cover all safety aspects in Ex environments and to complement the Certified Equipment Scheme, IECEx...
has developed the IECEx Certification of Personnel Competence Scheme for assessing and certifying individuals working in potentially hazardous areas.

The IECEx Certificate of Personnel Competence (CoPC) provides independent proof that the certificate holder has the required qualifications and experience for working on electrical equipment located in hazardous areas and can implement IEC International Standards covering explosive atmospheres.

For the CoPC, competence is defined as “the ability to apply knowledge” rather than simply assessing knowledge. In this sense, the assessment of persons includes assessing their ability to perform certain Ex-related tasks.

A hard lesson to be learnt
Who would have thought that powder sprayed over a crowd in a water park could produce such an explosion and massive fire? It looks like that kind of entertainment had been performed many times before this fateful day in June that ended in tragedy. One can only hope that when planning future events, party organizers will remember what happened and won’t overlook the potential risks associated with the use of powder and dust.

More information: www.iecex.com

...and in silos for grain storage

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**CONFORMITY ASSESSMENT**

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**Claire Marchand**

**Electronics are everywhere in commercial and office buildings. Elevators, escalators, automatic sliding doors or lighting all rely heavily on electronics nowadays. The same can be said of most of the smaller devices that equip stores and offices. While safety is an important issue for any electronic device, it is becoming crucial for equipment that is used by hundreds, if not thousands, of people every day.**

**Safe ride**

Take escalators, for example. They are everywhere: in office buildings, shopping malls, department stores, train and underground stations.

They usually have pictograms warning of the dangers of improper use, especially when small children are involved. But manufacturers don’t just rely on good behaviour to prevent accidents from happening. With the emergence of new technologies in the electronics sector in particular, they have put in place many other safeguards to make their products safer.

Today’s escalators are full of switches, sensors, detectors and more. There are switches that stop the escalator if a foreign object gets caught between the steps and the landing.
There are handrail speed sensors that monitor how fast the handrail moves. If the sensor notices a speed difference between the handrail and the steps, it sounds an alarm, pauses, and then automatically stops the escalator.

In automatic-start/stop escalators there are sensor switches that automatically engage the escalator motion when a rider is detected on the first step of the entrance landing platform and stops the escalator when there are no riders on the unit.

There are step demarcation lights, either fluorescent or more recently LEDs (light-emitting diodes). The illumination between the steps improves the passengers’ awareness of the step divisions.

**Safety comes first**
Reliability, safety and performance are of the utmost importance for escalators and all other devices used extensively by a great number of people. One faulty piece of equipment may have disastrous consequences: the escalator won’t stop when something gets caught between steps and landing, sliding doors will close when someone is passing through, and so forth.

This is why it is essential for manufacturers to use high-quality and reliable electronic components when manufacturing their products and equipment.

**IECQ plays leading role**
Electronic component manufacturers and suppliers all over the world have a very powerful tool at their disposal to make sure their component products and assemblies meet the strictest requirements: IECQ testing and certification. IECQ is the IEC Quality Assessment System for Electronic Components.

As a worldwide approval and certification system covering the supply of electronic components, assemblies and associated materials and processes, IECQ tests and certifies components using quality assessment specifications based on IEC International Standards.

The wide range of electronic components covered by IECQ is used in all kinds of technologies, from the smallest device to the very complex equipment.

IECQ operates industry specific Certification Schemes:
- IECQ AP (Approved Process)
  - IECQ AP-CAP (Counterfeit Avoidance Programme)
- IECQ AC (Approved Component)
  - IECQ AC-TC (Technology Certification)
  - IECQ AC-AQP (Automotive Qualification Programme)
- IECQ Scheme for LED Lighting
- IECQ Avionics
- IECQ HSPM (Hazardous Substances Process Management)
- IECQ ITL (Independent Testing Laboratory)

IECQ’s contribution to a safer and more reliable world can only increase with the development of new technologies and state-of-the-art electronic devices.

More information: www.iecq.org
Smart Grid in the power sector
An advanced and complex system

Thahirah Jalal, Unison Networks Limited, New Zealand / IEC 2014 Young Professional Leader

Electricity delivery from power stations to consumers’ premises had been achieved since the 19th century. Electricity networks are known as the most complex man-made system. Hence, the technologies available to generate, transmit and distribute electricity had always been advanced and contemporary for their time.

Smart Grid defined
The term “Smart Grid” refers to the utilization of technologies, tools and techniques to further modernize the electricity grids. Since the introduction of the term “Smart Grid”, there have been many critics who asked “Was the grid dumb before this?” The answer is “No” because there had been some smart technologies in existence but they were too expensive for mass rollout and hence, in the past, their applications were limited for critical infrastructures only. However, with the rapid advance in electronics, communications and computer technology these days, smart technologies can now be built at lower prices and hence can be widely deployed.

The key technologies for a Smart Grid are sensors that measure the relevant parameters such as temperatures, voltage and current; communication methods that allow two-way communications to a device; control systems that allow a device to be reconfigured remotely; and user-interface and decision support systems that provide an overview of asset status and perform advanced analytics on data to provide information.

Anticipated benefits
Many countries have invested considerably into Smart Grid initiatives. They have been motivated by the various benefits that are anticipated from Smart Grid deployment. One of the key drivers for Smart Grid implementation is reliability. Sensors perform real-time measurements across the network, creating higher visibility of the network’s status and condition. Advanced Distribution Management Systems are available to handle more real-time data, providing analytics and grid self-healing capabilities by remotely opening and closing switches.

Many countries are also shifting towards Energy Efficiency and Renewable Energy resources in their endeavours to reduce carbon emission. This shift introduced new challenges and called for new ways of managing energy, such as enabling active participation by consumers in demand response. Through smart meters and real-time communication, devices in consumers’ homes can be controlled to reduce peak demand. Renewable Energy resources are volatile in nature – transmission connections to the renewable power plants can be optimized by using dynamic rating.

The edge
The Smart Grid is now shifting its emphasis to its Grid Edge. More and more devices installed at the peripheries of a network will have embedded intelligence to automatically deliver reliability and power quality. An example of a Smart Grid edge device is a smart inverter that ensures that power delivered from solar panels will be compatible with the grid.

However, there are individuals that are skeptical about whether the benefits can be achieved or not. A simple analogy is like switching from a normal mobile phone to a smart phone. If the user is only using the smart phone to make phone calls, then he/she will not benefit from the features of using the internet for video conferencing etc. Similarly, if a utility has invested in smart meters, they will need to make new business decisions based on the information they receive from them. Otherwise, the benefits of the smart meters will not be fully optimized.

International roundup
In the United States, the American Recovery and Reinvestment Act of 2009 (Recovery Act) provided the US Department of Energy with USD 4.5 billion to modernize the electric power grid. The two largest initiatives launched following the Act are the Smart Grid Investment Grant (SGIG) and the Smart Grid Demonstration Programme (SGDP), which spanned over five years. The SGIG focuses on deploying existing Smart Grid technologies, tools, and techniques to improve grid
performance today, whereas the SGDP explores advanced Smart Grid and energy storage systems and evaluates performance for future applications.

In China, more than USD 200 billion has been committed to Smart Grid projects with the objective to deliver a reliable national grid that is capable of transmitting power from conventional and Renewable Energy sources. With China currently being the world’s largest market for power transmission and distribution technology, its Smart Grid market will be large and influential.

In Europe, the European Technology Platform for Electricity Networks of the Future (ETP SmartGrids) is the key forum to formulate policies and development pathways for the Smart Grid sector of European electricity network. The European Commission aims to replace 80% of electricity meters in Europe with smart meters rollout by 2020.

The concept of wide area electricity network known as Super Smart Grid (SSG) to connect Europe with northern Africa, the Middle East and Turkey has been introduced to provide consumers with a single European energy market that makes the most of different types of power generation and optimizes the costs associated with managing and maintaining an evolving grid infrastructure.

The importance of standardization
In most countries, Smart Grid projects are still ongoing. With more technologies being developed, new technology trials will continue, resulting in a Smart Grid consisting of millions of old and new parts and pieces which all need to work harmoniously with each other. This is where standardization becomes crucial in ensuring system compatibility.

Given the multidisciplinary nature of the Smart Grid, over 100 IEC Standards have been identified as relevant. The Smart Grid standards map can be viewed at: http://smartgridstandardsmap.com

A System Committee (SyC) Smart Energy has also been recently set up to provide systems level standardization, coordination and guidance in the areas of Smart Grid and Smart Energy. Key standards such as the IEC 61850 have been introduced to ensure device and communication compatibility in substations while IEC 61970 has been developed to define application program interfaces for energy management systems.

The Smart Grids around the world will continue to evolve, piece by piece, over time. They will likely transform the way we use electricity in our daily lives, similar to how the Internet has already changed the way we work, learn and entertain ourselves.

IEC Young Professionals Programme
This Programme brings together the world’s upcoming expert engineers, technicians and managers. It provides them with opportunities to shape the future of international standardization and conformity assessment in electrotechnology.
IEC 2015 Awards
Recognizing commitment to the IEC

Claire Marchand
Every year the IEC honours the commitment and work of a number of individuals in its community who, through their leadership and technical expertise, have contributed to making products and electrical systems safer, more energy efficient, more reliable and more compatible.

Thomas A. Edison Award
Created in 2010, the annual Thomas A. Edison Award recognizes exceptional achievements of Technical Committee/Subcommittee (TC/SC) officers and their IEC Conformity Assessment (CA) Systems counterparts.

To be nominated, TC and SC officers need to be active in IEC work. They must also have made an outstanding contribution to IEC systems and international standardization work, helping their committees to work more effectively on behalf of key stakeholders. The Award is given to up to nine recipients each year by the Standardization Management Board (SMB) and Conformity Assessment Board (CAB). Seven of these are reserved for TC/SC officers, and a maximum of two for officers in the CA bodies.

In 2015, the SMB chose seven TC/SC Officers:
- Margie M. Burk, Assistant Secretary of TC 61: Safety of household and similar electrical appliances, TC 72: Automatic electrical controls, and TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology
- Chen Bo, Secretary of TC 85: Measuring equipment for electrical and electromagnetic quantities
- Cheolung Cha, Secretary of TC 47: Semiconductor devices
- Pietro Di Vita, Chair of SC 86C: Fibre optic systems and active devices
- Tadashi Ezaki, Secretary of TC 100: Audio, video and multimedia systems and equipment
- Jae-Young Lee, Technical Area Manager of TC 100 TA 4: Digital system interfaces and protocols
- Reinhard Nerke, Secretary of SC 3D: Product properties and classes and their identification

Four of the 2015 IEC Thomas A. Edison Award laureates will receive their honours from IEC Vice-President and SMB Chairman Jim Matthews during the SMB session at the 2015 IEC General Meeting in Minsk.

The CAB will bestow the Award on:
- Ralph Wigg, IECEx (IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres).

IEC 1906 Award
Certification to Standards Relating to Equipment for Use in Explosive Atmospheres.

Ralph Wigg will receive the Award from IEC Vice-President and CAB Chairman Ulrich Spindler during the CAB meeting in Minsk.

1906 Award
The IEC 1906 Award was established in commemoration of the Commission’s foundation in that year and honours technical experts around the world whose work is fundamental to the IEC. Each year a maximum of five awards may be granted per TC, including its various subcommittees.

A total of 142 experts from 49 TCs (including ISO/IEC JTC 1) and 15 experts from the four CA Systems, representing 21 NCs, were nominated to receive this year’s 1906 Award. It recognizes exceptional recent achievements that contribute in a significant way to advancing the work of the Commission.
Latest nominations and extensions
Technical Committee Chairs beginning their terms in August and September

Zoë Smart
The Standardization Management Board (SMB) has approved the following IEC Technical Committee (TC) Chair nominations and extensions.

About Bob Mitchell
New TC 47 Chair Bob Mitchell is Corporate EMC Program Manager at Analog Devices. He has more than fifteen years’ experience as an EMC Engineer, having worked with automotive, military and aerospace suppliers and direct contractors on EMC projects. Mitchell has been involved with the IEC as voting US Delegate for more than 3 years and with standardization in general for the past 12 years. He takes over as Chair of TC 47: Semiconductor devices on 1 September for a period of 6 years.

About Andreas Starke
Andreas Starke is new Chair of TC 48: Electrical connectors and mechanical structures for electrical and electronic equipment. He holds a PhD from the Technical University of Berlin and is General Manager of Intellectual Property and Standardization at HARTING Technology Group. Starke first got involved with standardization in 2006 as a CENELEC expert and has been a member of the council of the German National Committee (NC) since 2010. He is Member of a number of IEC Working Groups (WG) within TC 48 and the corresponding mirror committee within the German NC. Between 2009 and 2011 he was a Member of SC 23H MT8 which is in charge of the IEC 62196 series on EV plugs and sockets.

About Lutz Hofmann
Lutz Hofmann new Chair of TC 73: Short-circuit currents is Full Professor and Head of the Institute of Electric Power Systems at the Leibniz University Hannover and Head of the Transmission Networks department at the Fraunhofer Institute for Wind Energy and Energy System Technology in Kassel, Germany.

German Member of TC 73/WG 1: Short-circuit currents, Hofmann is also member of the DIN Standard Committees K121 and UK121, as well as Member of CIGRE. He is the author of several publications on power system modelling and calculation of steady states and transients in power systems.

About Hannu Peiponen
An electrical engineer, Hannu Peiponen is Technical director responsible for rules, regulations and type approval at Furuno Finland Oy, a supplier of marine electronics. He takes over as Chair of TC 80: Maritime navigation and radiocommunicaton equipment and systems on 1 September for a period of six years.

Peiponen has been involved with TC 80 since 1995 for which has been Working Group Member and Convenor for multiple Standards. He is currently Convenor of WG 6: Digital interfaces and Finnish delegate to TC 80 plenary meetings. In 2013 he received the 1906 Award for his TC 80-related work.

Extensions
The SMB has approved the extension of the term of office of Yoshiaki Ichikawa, Chair of TC 111: Environmental standardization for electrical and electronic products and systems for the period 2015-08-01 to 2018-07-31.

Roger C Wicks, Chair of TC 112: Evaluation and qualification of electrical insulating materials and systems has had his term of office extended for a further three years, as of 1 October 2015.
The medical devices industry encompasses a wide range of items and technologies, from the simplest wound dressing to highly sophisticated diagnostic and therapeutic equipment. Globally, the sector is worth more than USD 360 billion (2014) and is expected to grow steadily in the future.

Expanding sector
Worldwide, demand for medical care keeps growing, for a number of reasons. They include aging populations in most regions and increased access to medical services in developing countries. This increasing demand for care drives the need for more medical electrical equipment (MEE) and medical electrical systems (MES). Technology also plays a role in this expansion as traditional manual or mechanical medical equipment and devices, such as blood pressure meters, are being replaced by their electronic equivalent.

Wide scope of application
When MEE and MES are mentioned, the word “hospital” springs to mind as it represents the environment in which they are most widely deployed for diagnostics, surgical intervention, post-surgery care, irradiation and other therapies. However, MEE and MES are also found in other treatment centres. They are used in dental, skin, aural and ophthalmic care, and also for rehabilitation and assistive care.

International Standards for MEE and MES are prepared by a number of IEC Technical Committees (TCs) and Subcommittees (SCs). IEC TC 62: Electrical equipment in medical practice, is central to this process. Its main publication of the IEC 60601 family is, together with its collateral standards, the essential foundation for Standards for MEE and MES. They reference many International Standards prepared by more than two dozen other IEC TCs and SCs.

Raising awareness in China
China’s medical device industry has been growing rapidly in recent years and the government and enterprises are increasingly paying attention to and placing emphasis on participation in international standardization.

Taking the opportunity offered by the 73rd China International Medical Equipment Fair (CMEF), IEC TC 62, together with China Standard Committee for Medical Electrical Equipment and China Standard Committee for X-Ray Medical Devices and Tools, organized the first “IEC International Medical Equipment Standards Forum” in Shanghai on 16 May 2015. Also on the organization...
board were ReedSinoPharm China, the Liaoning Medical Device Test Institute and the Shanghai Testing and Inspection Institute for Medical Devices.

The half-day event focused on International Standards for medical equipment as well as mechanisms and strategies for enterprises participating in international standardization. The accent was on the challenges posed by novel technologies and the third edition of IEC 60601 on standards for medical equipment.

Attendees included standards developers, medical industry experts, medical equipment and service companies, manufacturers, research institutes and media representatives.

High-level presentations

Chaired by Yan Kang, Chairman of IEC SC 62B: Diagnostic imaging equipment, the Forum saw eight speakers taking the floor to address the audience on specific topics.

Jingli Li, Director of the Center for Medical Device Standardization Administration, CFDA, gave an introduction on the medical device standardization administration in China. She explained in details the standardization structure for medical device in China, the process of standards development and encouraged more active participation from private companies. Today, industry participation in this sector is about 46%.

Li was followed by Dennis Chew, Regional Director of the IEC Asia-Pacific Regional Centre (IEC-APRC), who provided an overview of the IEC including its management structure and the process for developing an International Standard. He also talked about the different types of publications to meet different needs, saying that medical equipment is covered under the IECEE CB Scheme.

On IEC 60601

Zhuohui Sun, Manager of Regulatory Affairs at GE Healthcare China, gave an industry perspective on the standardization structure for medical devices in China and the challenges associated with the implementation of the IEC 60601 series and the use of different versions, especially with respect to its generic requirements in Part 1 and specific requirements in other parts.

The IEC 60601 series of International Standards also formed the core of Norbert Bischof’s address. He gave an overview of IEC work in the medical sector and a detailed explanation of the structure of IEC TC 62 and its Subcommittees and the challenges and benefits in implementing IEC 60601 in its current modular approach.

Importance of participating in standards development

Jiahua Huang, Director of the Shanghai Testing and Inspection Institute for Medical Devices, emphasized that it is not enough to continue with passive usage but to actively track and participate in the development of international standards to facilitate implementation. He also enumerated the key characteristics required of an expert, including solid technical expertise, strong communication skills, familiarity with the IEC/ISO Directives and a good command of the English language.

Robotics in the medical field

Gurvinder S. Virk, Convenor of IEC SC 62A JWG 9* on medical electrical equipment and systems using robotic technology, explained the distinction between industrial and service robots, the need for robot standards, and made a detailed comparison between robots as machines and robots as medical devices. He also presented the work of JWG 9 on IEC TR 60601-4-1, Medical electrical equipment - Part 4-1: Guidance and interpretation - Medical electrical equipment and medical electrical systems employing a degree of autonomy.

Virk added that robotics is moving towards new service application domains and new challenges are emerging for personal care robots and medical robots. For him, standardization is vital to ensure safety...
and success for the new and upcoming international robot markets.

The benefits of participating in IEC work
Jianjun Wang, Deputy Director of Liaoning Medical Device Test Institute, gave examples of how Chinese companies have benefited by networking with international experts. Some of the benefits include having a better understanding of the requirements expressed in certain clauses. He added that by participating in the IEC, Chinese enterprises will have a better understanding on the changes and trends of international medical device standards and be able to develop and upgrade their products to the latest standards.

The Forum made important contributions to promoting participation of Chinese medical equipment enterprises in international standardization, and to strengthening exchanges between Chinese and international standardization experts. Because of this extremely successful outcome, the organizers are making plans to hold the Forum on an annual basis in conjunction with the CMEF.

* JWG 9 is linked with ISO/TC 184/SC 2

Celebrating World Standards Day 2015

Mexican team creates winning video

Zoë Smart

On October 14 the members of the IEC, ISO and ITU will be celebrating World Standards Day as a means of paying tribute to the collaborative efforts of the thousands of experts worldwide who work on developing International Standards.

The world’s common language
This year’s theme is ‘Standards – the world’s common language’ and for the first time participants were asked to submit a short video, rather than a poster, to demonstrate what it would be like to live in a world in which International Standards were absent.

The competition attracted more than 130 entries from around the world with participants covering everything from clothing sizes, to interoperability, to efficiency and safety. IEC, ISO and ITU selected the top 10 candidates and put them up for public vote.

Signs matter!
The winning team, from Mexico, is comprised of Gabriel Enrique Hernández García, who works in the multimedia and innovation section of a certification body; Norma Noemí Herrera Ramirez, a biomedical engineer; Edgar Antonio Hernández Garcia, a graphic designer and Miguel Ángel Romero Cortés, an enthusiastic teenager who loves playing soccer!
Their video ‘Signs matter’ received half of the nearly 6,500 votes and demonstrated the importance of standardized graphical symbols in everyday life.

Talking about their video, the team said, “It was a lot of pressure, but we have the reward thanks to the help of our families, co-workers, partners, friends and supporters around the world. Thanks to ISO, IEC, and ITU to allowing us to participate in this experience!”

The team receives CHF 1 500 and their video will be used worldwide to celebrate World Standards Day on 14 October 2015.

Three runners up also receive an award of CHF 500. They are:

An Armenian team of coworkers from animation studio Orbeli Productions, for their video depicting the importance of Standards for safety.

Gabriel Hernandez and Noemi Herrera with their first video entry illustrating how Standards ensure quality and safety within the milk food chain.

A team from the Thai Industrial Standards Institute (TISI) going under the name OMG Plus, for their video on the importance of Standards for Electromagnetic Compatibility (EMC).

The theme of this year’s video competition was ‘Standards - the world’s common language’

Upcoming global events
IEC participants may get discount on attendance fees

Claire Marchand
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 events that may be of interest to the IEC community.

CIGRE/IEC International Symposium 2015 – Development of electricity infrastructures in sub-Saharan Africa
Cape Town, South Africa
26-30 October 2015
The Symposium invites transmission, distribution generation owners, system operators, suppliers, designers, traders, regulators, research laboratories and universities to exchange ideas for the development of electrical systems in Sub-Saharan Africa.

For registration, including programme, accommodation and tours, please visit the CIGRE website.

**Using and referencing ISO and IEC Standards to support public policy conference and training**
Geneva, Switzerland, 2-3 November 2015

On the agenda: Discover how to reference standards in regulations, how they can help implement policy commitments taken at the global level and more.

Attendees: IEC and ISO Members, regulators and policy makers, other international organizations.

Venue: Palais des Nations, Geneva, Switzerland, hosted by UNECE

**Interlight Moscow**
Moscow, Russia, 10-13 November 2015

Interlight Moscow is the biggest show in Russia and Eastern Europe covering the whole range of products relating to lighting, electrical engineering, home and building automation. Lighting industry companies, manufacturers, engineers and energy consumers will hear from Russian industry, trade and energy ministers and standards experts about: International Standards, lighting standards in the Russian Federation, the role of standardization in Russia, modern measuring equipment for testing laboratories, accreditation and more.

For more information on the forum, please go to the Interlight Moscow website.

**Fuel Cell Seminar and Energy Exhibition**
Los Angeles, USA, 16-19 November 2015

Clean energy professionals, stakeholders and opinion leaders will discuss latest developments in fuel cell and hydrogen markets, policies, and research. Product displays and the possibility to test drive the latest fuel cell electric vehicles are also on the programme.

More information on the event’s website at fuelcellseminar.com/

**SWICON 2015 - 9th International Conference on Switchgear & Controlgear Technology**
Mumbai, India, 26-27 November 2015

Industry experts will discuss latest developments, energy technology trends, international standards, best practices and more, for switching, protection, control and communication for low, medium, high and extra high voltage power systems.

For more information on the Conference, please visit swicon2015.com/

**WSC Conformity Assessment Workshop**
Geneva, Switzerland, 1-2 December 2015

This 1 1/2 days event is held in conjunction with the UNECE WP 6 meeting.

At this World Standards Cooperation event, experts will discuss conformity assessment issues, exchange practical experience and propose working solutions. Participants can choose topics of interest and will receive a takeaway package. Attendees will include regulators, industry representatives, transition economy leaders, economic leaders and other interested stakeholders.

For registration and information, please go to the workshop website at www.wsccaworkshop.com/
**EVs charging wirelessly**

Future EVs may not need to plug in to charge their batteries

**Morand Fachot**

The growing number of electric vehicles (EVs) on the roads relies on cabled connections to the grid for charging. Wireless power transfer (WPT) is seen as an attractive alternative to plug-in charging. The IEC has published the first in a series of International Standards aimed at paving the way to the adoption of WPT for EV charging.

**EVs on the march**

With growing concern about the environmental impact of vehicles powered by internal combustion engines (ICEs), EVs represent an attractive solution for the future of personal and public transport.

Hybrid EVs, which initially relied on various technologies such as regenerative braking or an ICE to recharge their batteries, first became available in the late 1990s. The introduction of plug-in hybrid EVs (PHEVs), which can be recharged by connecting a plug to the grid, marked an advance on ICE-hybrid EVs, with a longer all-electric range. There are some 10 million hybrid EVs on the roads today.

By mid-September 2015, the global number of plug-in EVs broke the one million mark, with all-electric EVs making up 62% of the total and PHEVs 38%.

**Drawbacks of plug-in EVs**

As their description indicates, for charging their batteries, plug-in EVs must be connected to the power grid through a cable and a plug. It is rare to find charging points in public places and on streets in most countries and they are costly to install. Furthermore, many are being damaged either accidentally or intentionally (theft of cable, hostility to EVs, etc.).

A solution in the form of WPT can prove attractive if it can be deployed.

IEC Technical Committee (TC) 69: Electric road vehicles and electric industrial trucks, has been developing International Standards for WPT. The first of these Standards, IEC 61980-1:2015, *Electric vehicle wireless power transfer (WPT) systems – Part 1: General requirements*, was published in July 2015.

**Setting the groundwork**

IEC 61980-1 covers general requirements for WPT for EVs.

The requirements for the various WPT technologies are very different and will be treated in technology-specific parts of the 61980 series. These technologies include:

- Inductive power transfer, in which energy is transferred through magnetic field (MF-WPT). This includes technologies utilizing magnetic resonance
- Capacitive power transfer, in which the energy is transferred through an electric field (EF-WPT)
- Microwave power transfer, in which the energy is transferred through electromagnetic waves in the range 1 GHz - 300 GHz (MW-WPT)
- Infrared power transfer, in which the energy is transferred through electromagnetic waves in the range 300 GHz – 400 THz range (IR-WPT)

Interoperability of a WPT system is only achievable when the primary devices (which provide the contactless coupling) and the secondary devices (mounted on the EV) employ the same type of transfer technology.

Demonstration of WPT EV charging at Tokyo Motor Show 2011 (photo: NJo)
The efficiency will be specified in the technology-specific parts of IEC 61980 series.

Multiple aspects
The scope of this part of IEC 61980 states that it “applies to the equipment for the wireless transfer of electric power from the supply network to electric road vehicles for purposes of supplying electric energy to the rechargeable energy storage system (RESS) and/or other on-board electrical systems in an operational state when connected to the supply network, at standard supply voltages ratings per IEC 60038 up to 1 000 V AC and up to 1 500 V DC”.

It “also applies to WPT equipment supplied from on-site storage systems (e.g. buffer batteries, etc.)”.

Aspects covered in IEC 61980-1 include:
- the characteristics and operating conditions
- the specification for the required level of electrical safety
- requirements for basic communication for safety and process matters if required by a WPT system
- requirements for basic positioning of the primary and secondary devices, efficiency and process matters if required by a WPT system
- requirements for two- and three-wheel vehicles (under consideration)
- requirements for dynamic WPT system while driving (under consideration)
- requirements for bidirectional power transfer (under consideration)
- specific EMC requirements for WPT systems

However, this Standard does not apply to safety aspects related to maintenance or to trolley buses, rail vehicles and vehicles designed primarily for off-road use.

Installation and environmental conditions
IEC 61980-1 lists the various types of installation, which depend on the type of secondary device on the EV:
- ground mounted, including:
  - in-ground mounted (e.g. under road surface)
  - on-ground mounted
  - over stand (e.g. for motorbikes, scooters)
- vertical surface mounted (e.g. wall mounted)
- on-roof mounted.

Furthermore, the Standard classifies the EV WPT supply equipment according to environmental conditions and use: indoor use, outdoor use or industrial area exposed to pollution and/or severe conditions.

Comprehensive scope covers multiple requirements
A non-exhaustive list of general and constructional requirements contained in this Standard includes, in addition to classification, interoperability, installation and environmental conditions, control and communication between the EV supply equipment and the EV, protection against electric shock and EMC-related immunity and
Software is often an integral part of medical device technology and trends point to its growing importance in it. A consolidated version of IEC 62304, *Medical device software – Software life cycle processes*, has just been published. This International Standard provides a framework of life cycle processes with activities and tasks necessary for the safe design and maintenance of medical device software.

In its Strategic Business Plan, IEC Technical Committee (TC) 62: Electrical equipment in medical practice, notes that “software and the integration of medical electrical equipment and systems with IT networks will be an integral element affecting almost all aspects of the [TC] work.” It further states that in recent years it “has increasingly worked in the field of software, IT and networks and developed new International Standards and other publications in that area.”

IEC Subcommittee (SC) 62A: Common aspects of electrical equipment used in medical practice, develops a number of disturbance requirements. Service and test conditions are also detailed and a number of use cases are described.

This first Standard in the IEC 61980 series focuses currently on stationary WPT systems. However the technology is expected to lead eventually to dynamic WPT-enabled infrastructure where EVs can be charged continuously while in motion, solving the EV battery problem with unlimited driving range.

IEC 61980-1:2015 is a decisive first step on the road to WPT adoption.
of International Standards that are specifically related to software issues.

**Consolidated version includes significant additions**
The consolidated version of IEC 62304, includes the initial Standard, published in 2006, and Amendment 1 (2015), which adds requirements to deal with legacy software, to assist manufacturers who must show compliance to the Standard to meet European Directives. Clarification of requirements and updating of the software safety classification to include a risk-based approach have also been added to the amendment.

**Covering all aspects**
The scope of this standard is quite wide, it “applies to the development and maintenance of medical device software when software is itself a medical device or when software is an embedded or integral part of the final medical device.”

It is also “to be used together with other appropriate standards when developing a medical device.”

In addition to terms and definitions, the Standard lists general requirements, which include conditions applying to legacy software, and details:
- Software development process (development planning, requirements analysis, architectural and detailed design, implementation and verification, integration and integration testing, software system testing and release)
- Software maintenance process
- Software risk management process, with risk being defined as the combination of the probability of occurrence of harm [physical injury, damage, or both to the health of people or damage to property or the environment] and the severity of that harm
- Software configuration management process
- Software problem resolution process

**Standard available as Redline version**
Given the extent of changes in this consolidated Standard, it is available as a Redline version with track changes.

Redline versions (available in English only) provide users with a quick and easy way of comparing all the changes between standards and their previous edition, as such they are highly valued. In Redline version, a vertical bar appears in the margin wherever a change has been made. Additions and deletions are displayed in red, with deletions being struck through. First introduced in 2008, Redline versions are now available for over 50 International Standards.
The year in review

Issue 07/2015 of e-tech will be distributed to all attendees at the IEC General Meeting in Minsk, Belarus. It takes a look back over some of the previous year’s events and highlights since Tokyo in November 2014, in terms of technical developments, standardization and conformity assessment activities as well as strategic meetings.

Summary articles cover important Technical Committee (TC) work in areas as diverse as renewable energies, Smart Cities and Smart Grids, energy storage, medical equipment including wearables, transportation and audiovisual.

The review also focuses on major developments in the four IEC Conformity Assessment Systems – IECEE, IECEx, IECQ and IECRE.