

IEC

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*news & views from the IEC*



# Smart machines

## **Technology focus**

Paving the way for smart farming  
Smart tools for home gardeners

## **Technical Committees**

How secure is your data self?  
Virtual reality makes real life even better  
Shaping the circular economy





*AI and big data are revolutionizing farming*

# Machines becoming smarter and more intelligent

Agricultural and garden machines are making the most of big data and AI



Zoë Smart  
Managing Editor e-tech

It's not only computers, wearables and gadgets that are making use of smart applications and big data to provide users with personalized services.

Machines that have traditionally been used for labour-intensive or physically hard work – think tractors or lawn mowers – are now able to provide much more than just power.

Agricultural robots that use sensors to pick and harvest ripe fruit and vegetables, are being introduced on farms. Others use collected data to spray plants with fertilizers and herbicides as needed, rather than on the whole crop, making the process more efficient and more environmentally friendly.

In the gardening sector, the smart tools market is growing rapidly, with robotic lawn mowers being the best-sellers. Some of the more advanced machines have

built-in sensors to detect obstacles or rain and can even access weather forecasts online.

Underlying the innovation in these, and many other technologies, are international standards. They provide engineers and manufacturers with a solid base from which to build their products, allowing them to concentrate on innovation, without having to reinvent the wheel. Because international standards are consensus based, and industry stakeholders have largely been involved in their creation, they are widely adopted, allowing the technologies that make use of them to be deployed worldwide and products to be traded globally.

But it is not only manufacturers that benefit from the use of international standards, with them, end users can rest assured that the machines they have in their hands, or on their land, are safe and can be trusted to work as expected.

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*The Oz weeding robot for vegetable crops  
(Photo: Nao Technologies)*

# Robots, AI and big data pave way for smart farming

Using them will help meet more environmentally-friendly nutritional needs

By Morand Fachot

The introduction of robots, artificial intelligence (AI) and big data in agriculture marks the fourth phase in modern farming, the so-called Agriculture 4.0. It follows the first one, which dates back to the introduction in Britain, in the early 18<sup>th</sup> century, of basic machinery using animal power to execute simple tasks, and the second phase, which started after tractors were first used around 1918, leading to the introduction of more powered machines. The current, third farming model, industrial agriculture, applied in many developed countries, is often based on monoculture relying on the wide use of machinery, phytosanitary products like herbicides, fertilizers and insecticides. Likewise, raising animals for meat or milk production is based on industrial methods.

All models have boosted productivity and freed labour for industry. However, the current model is seen as unsustainable and damaging to health and the environment owing to hidden costs, such as acute poisoning and long-term chronic illnesses from herbicides and insecticide toxicity, water pollution from fertilizer runoff, animal waste (that may contain hormones and antibiotics), land depletion, erosion and loss of biodiversity.

## Automation, AI and big data – a possible paradigm shift?

Food production across the world faces many challenges: it must meet the need to feed a rapidly-growing global population by boosting production with a shrinking workforce, cut waste (estimated at some 30 per cent of global production) and minimize environmental damage. Modern technologies, such as robots, AI and processing huge amounts of relevant data (big data) can now be applied to farming, which they are set to transform radically allowing more efficient and sustainable food production.

There are several kinds of farm robots, a handful of autonomous robots that can move around and work without human intervention, and others.

Dutch company Cerescon developed an asparagus harvester attached to a tractor. It can look deep underground and harvest asparagus that manual harvesters wouldn't see emerge until the next day, the day after that, or even three days later. This enables the machine to harvest in one go everything that 60 to 75 manual harvesters would, but having to return on one to three

consecutive days. This represents a huge improvement.

## Enter Tom, Dick and Harry, with Wilma, and other workfollows

In industry, robots are designed and programmed to execute a limited number of tasks in a set environment and can be reprogrammed for other tasks. In agriculture the wide variety of operations required, even for a specific crop on a single field, and the variable locations mean that several robots are currently needed for different tasks, such as planting, tending or harvesting.

The need to have different machines for these tasks means that robot manufacturers have designed bespoke devices. The British based Small Robot Company has developed three small autonomous robots, Tom, Dick and Harry, which it offers through its Farming as a Service (FaaS) model.

Tom monitors soil and plants on an individual basis, keeping track of the health and development of each plant. It collects data and works closely with Wilma, the company's AI driven operating



*This robot from the Small Robot Company micro-sprays each plant with fertilisers or chemicals as required (Photo: Small Robot Company)*

system. Following its surveying task, Tom downloads the gigabytes of data it has collected for analysis by Wilma, which provides comprehensive digital crop models than can be used by Tom's stable mates, Dick and Harry.

Dick micro-sprays each plant with fertilizers or chemicals as required, to help it thrive. Dick also has three ways to deal with weeds. It can micro-spray a tiny amount of herbicide on each weed, burn it, or crush it as it comes out of the ground.

Harry is a robotic drill for various crops. It places individual seeds in the ground using accurate drilling for minimal soil disturbance and records exactly where it has placed them.

These agribots return to their "kennel" when they need power, where they are recharged or their battery replaced with a fully charged one.

A French company, Nao Technologies has produced three autonomous weeding robots, to which tools can be attached. They are used by wine growers, market and large-scale vegetable farmers. These agribots, being light and "intelligent", have a much-reduced environmental footprint compared to traditional machines and methods used in industrial agriculture. For vegetable crops, weeds can be eradicated individually using mechanical implements or using very small amounts of herbicides, replacing the need to spray large surfaces using tractors, crop dusters or helicopters. Operating costs (like fuel) are also much lower as they are electrically-powered.

### **IEC Standards central to agribot development**

All these autonomous robots depend on technologies and systems that rely on standards developed by IEC technical committees (TCs) and subcommittees (SCs).

Standards for primary and secondary batteries needed to power agribots are developed by TC 35, TC 21 and TC 69. Agribots use laser-based light imaging detection and ranging (LIDAR) systems to find their way around fields, and video and infrared/visible wavelength image sensors to identify plants and weeds, using computer-based image analysis, to apply fertilizer or herbicides, if needed, or remove weeds mechanically. TC 76 develops standards for laser applications, while TC 47 and its subcommittees, develop standards for semiconductors used in sensors.

Standards for AI and big data, increasingly important for Agriculture 4.0, are prepared by ISO/IEC JTC 1/SC 42, aSC of the Joint Technical Committee for Information Technology set up by IEC and ISO.

Milking robots still make up some 85% of all farming robots. Most other agribots are still limited to specific tasks or crops, but they are rapidly evolving and will be able to work on many more in the near future, replacing large and expensive farm equipment or hard to find farm labourers. They will have a much lower environmental impact on the land itself and also reduce the need for fossil-based fuels to power large machines or produce herbicides and fertilizers.



# Smart tools and apps for home gardeners

## Robots in the garden

By Peter Feuilherade

Home gardeners looking to upgrade their lawnmowers, sprinklers and outdoor lights can choose from a growing range of tools paired with smart technology, which need not cost the earth.

Networked and programmable garden devices fall into four main categories: robotic lawnmowers, sprinklers, sensors and outdoor lighting. Individual systems usually have associated apps that let users control the installations and devices remotely via smartphones and see how the garden is doing at any time.

Some of these products have evolved from technology already common in commercial agriculture that allows farmers to control their water and fertilizer resources and monitor the condition of their produce through the Internet of Things (IoT).

IEC develops an extensive range of international standards for the batteries, sensors, motors and other components used in electric gardening appliances aimed at domestic users. Safety and ease of operation are primary considerations.

### Robotic mowers make the cut

Robotic lawnmowers are the best selling smart gardening consumer product. They



*Robotic lawnmowers are the best selling smart gardening consumer product*

are powered by battery packs, typically lithium-ion, recharged from an AC-powered base station. Unlike traditional lawnmowers, robotic mowers cut only the tips of the grass, but do so regularly. Prices range from around USD 450 for a model for smaller gardens, up to USD 3 500 for a mower that will cut up to half an hectare.

Most robotic mowers need hidden boundary wires to keep them within the area to be trimmed and guide them back to the outdoor charging station. The latest high-end models use wireless beacons in the ground to calculate their position, and can operate autonomously after an initial manual training run to learn the layout. Some have built in sensors to detect garden structures and other obstacles.

Advanced robotic mowers include rain sensors and can access weather forecasts online. Users can connect to smartphones, mobile devices and artificial intelligence (AI) powered virtual assistants like Amazon's Alexa and Google Assistant to start and stop mowers through voice control and set up mowing schedules. Safety devices include lift and tilt sensors to turn the mower off in potentially dangerous situations.

IEC Technical Committee 116: Safety of motor-operated electric tools, prepares international safety standards for hand-held and transportable motor-operated electric tools and gardening appliances. Particular requirements apply for robotic battery powered electrical lawnmowers.

The global market for robotic lawnmowers grew fourfold from USD 200 million in 2012 to USD 800 million in 2018, and is predicted to reach USD 1 billion in 2022, according to a report by Euromonitor home and technology senior analyst Stefano Botter in February 2019.

The ease of use of domestic robotic lawnmowers with intelligent programming, accompanied by the increasing availability of low-cost mowers from China, is likely to boost sales to home gardeners.

Current models of cordless garden tools and appliances use mainly lithium-ion batteries that can provide higher charges, longer run time, less self-discharge and quicker charging than their nickel cadmium equivalents.

The work of IEC TC 21: Secondary cells and batteries, helps manufacturers increase battery efficiency, while making them more affordable to the public.

As more and more hand-held and transportable motor-operated electric tools and gardening appliances use batteries, SC 21A, which prepares standards for portable batteries among other types, plays an essential role in the development of cordless tools and gardening appliances.

### Just add water

Smart irrigation systems use sensors to monitor soil moisture levels around plants and water the garden accordingly, helping to save water. They can integrate with existing irrigation equipment, adjust sprinklers based on soil type and exposure to the sun, and generate a smart watering schedule based on the garden's location and vegetation.

Advanced irrigation systems adjust automatically to provide the right amount of

water based on local weather conditions. In addition to soil moisture sensors, they incorporate data from weather forecasts and plant-care databases to prevent overwatering when rain is imminent.

Smart watering systems can be controlled remotely through smartphone based apps and virtual assistants.

Sales of smart sprinkler controllers for domestic use reached around USD 390 million in 2017, according to the Indian company 360 Research Reports.

### Connecting sprinklers and sensors

Many smart gardening applications bring together sensors and web connected garden sprinklers and lawn irrigation systems.

Devices incorporating various sensors can let home gardeners know when lawns and plants are drying out, whether they are getting enough or too much light and even if the soil is right or not. They use sensors to measure pH, temperature, light levels and nutrients as well as moisture and humidity, and send the data to smartphone apps.

Connected apps analyse these variables and cross-check them with plant databases to offer gardeners customized advice on what to plant and when. They can alert users to changing weather conditions such as potential flooding, sudden temperature drops and high winds.

International standards prepared by TC 47: Semiconductor devices, SC 47E: Discrete semiconductor devices, and SC 47F: Microelectromechanical systems, enable manufacturers to build more reliable and efficient sensors and microelectromechanical systems (MEMS) used in these connected devices. TC 56:

Dependability, covers the reliability of electronic components and equipment.

### Helping your garden glow

Weatherproof outdoor smart lights, including colour-changing lights and motion activated lights that sync with a home security system, can brighten up outdoor spaces and light up dark areas. They offer enhanced security as they can be programmed to come on at specific times, or connected to motion sensors.





Outdoor LED lights give off extremely strong light at very low watts. Users can turn lights on and off, change brightness and set the colour of the lighting with an app via a smartphone or voice commands to a smart speaker.

Some smart lights require a hub, similar to a Wi-Fi router, that connects separate outdoor lights together, but the majority of smart garden lights do not.

International standards for lamps, electric light and lighting solutions are developed

by TC 34: Lamps and related equipment. Several subcommittees of TC 34 deal with special projects in the area of new technologies including LEDs and OLEDs.

### Safety first

Safety is a paramount consideration with all garden tools, whether they are traditional plug-in models or programmable cordless devices such as robotic lawnmowers. Mowers and other tools like hedge trimmers have a safety switch to prevent accidental starting.

Other safety features will automatically stop a robotic lawnmower if it is lifted up or turned over, and reduce its speed as soon as it senses a nearby object.

Manufacturers have also enlisted virtual reality (VR) technology to give gardeners the opportunity to try out and learn how to operate power tools such as hedge trimmers in a safe simulated environment before purchasing and using these potentially dangerous products.



Smart lights can also be synced to a home security system (Photo: Phillips)

# Measuring human exposure to 5G

IEC is sharing best practices to ensure accurate assessments of electromagnetic fields for 5G network and device testing

By Michael A. Mullane

5G is the latest generation of mobile network technology. It promises greater capacity, as well as significantly faster download speeds than the current 4G networks. It will mean loading the HD version of a three-hour movie like *Avengers: Endgame* in seconds, rather than the minutes it currently takes. More significantly, it opens up exciting new possibilities for a range of technologies, including the Internet of Things (IoT) and augmented and virtual reality (AR and VR).

“5G is set to revolutionize wireless communications and play a major role in our future connected society and facilitate the road towards a more advanced Internet of Things,” says Mike Wood, who chairs IEC Technical Committee 106, which prepares international standards on measurement and calculation methods to assess human exposure to electric, magnetic and electromagnetic fields. The members of TC 106 include global experts from mobile operators, mobile manufacturers, academia, government regulators and testing laboratories.

## Huge potential benefits

“Knowing the importance of 5G and wireless communications on a global scale is what drives our experts, who

dedicate many hours including significant personal time to work on international standardization,” Wood told *e-tech*.

When fully deployed, the technology will not only increase downloading and uploading speeds over the mobile network, but also provide the connection for billions of IoT devices, as well as reducing latency, which is the time that networks take to respond. This opens a wide range of new possibilities in robotics, vehicle and automotive safety systems, and remote medical applications.

In a practical sense, it will drastically lessen the annoyance of time spent buffering on your mobile device and provide a far better customer experience. More importantly, trials carried out around the world have already highlighted the massive potential benefits for industrial and medical applications. Earlier this year, the



5G antenna EME test (Photo: Telstra Labs)

Chinese media reported on 5G assisting remote brain surgery on a patient 3 000 kilometres away. Surgical operations using robot arms in remote locations would be impossible on conventional 4G networks because of the delays.

5G field trials are well underway and a number of operators are launching networks this year. 5G initially supported by 4G will serve as the much-needed communications backbone for the ever continuing growth in data and connectivity, from the billions of connected IoT devices, to self-driving cars and smart cities. Human safety and device compliance are obviously essential and this is an area where IEC work is well advanced. TC 106 is playing a key role with the recent publication of a new IEC Technical Report on evaluating human exposure to radio frequency fields in the vicinity of base stations. It follows the publication of a new standard (IEC 62232) in 2017.

## Safety relies on accurate data

IEC 62232 provides methods for determining the radio-frequency field strength near radio-communication base stations with the intention of evaluating human exposure. It takes into account the mmWave frequencies to be used for 5G networks. TC 106 has also established





5G UE test in car park (Photo: Telstra Labs)

three joint working groups with IEEE to develop international standards for 5G device testing in the near future:

- JWG 11 is studying computational methods to assess the power density in close proximity to the head and body. The aim is to develop a dual IEC/IEEE standard for computing the power density from wireless communication devices from 6 GHz to 300 GHz.
- JWG 12 deals with measurement methods to assess the power density in close proximity to the head and body. This should lead to a dual IEC/IEEE standard for measuring the power density of wireless

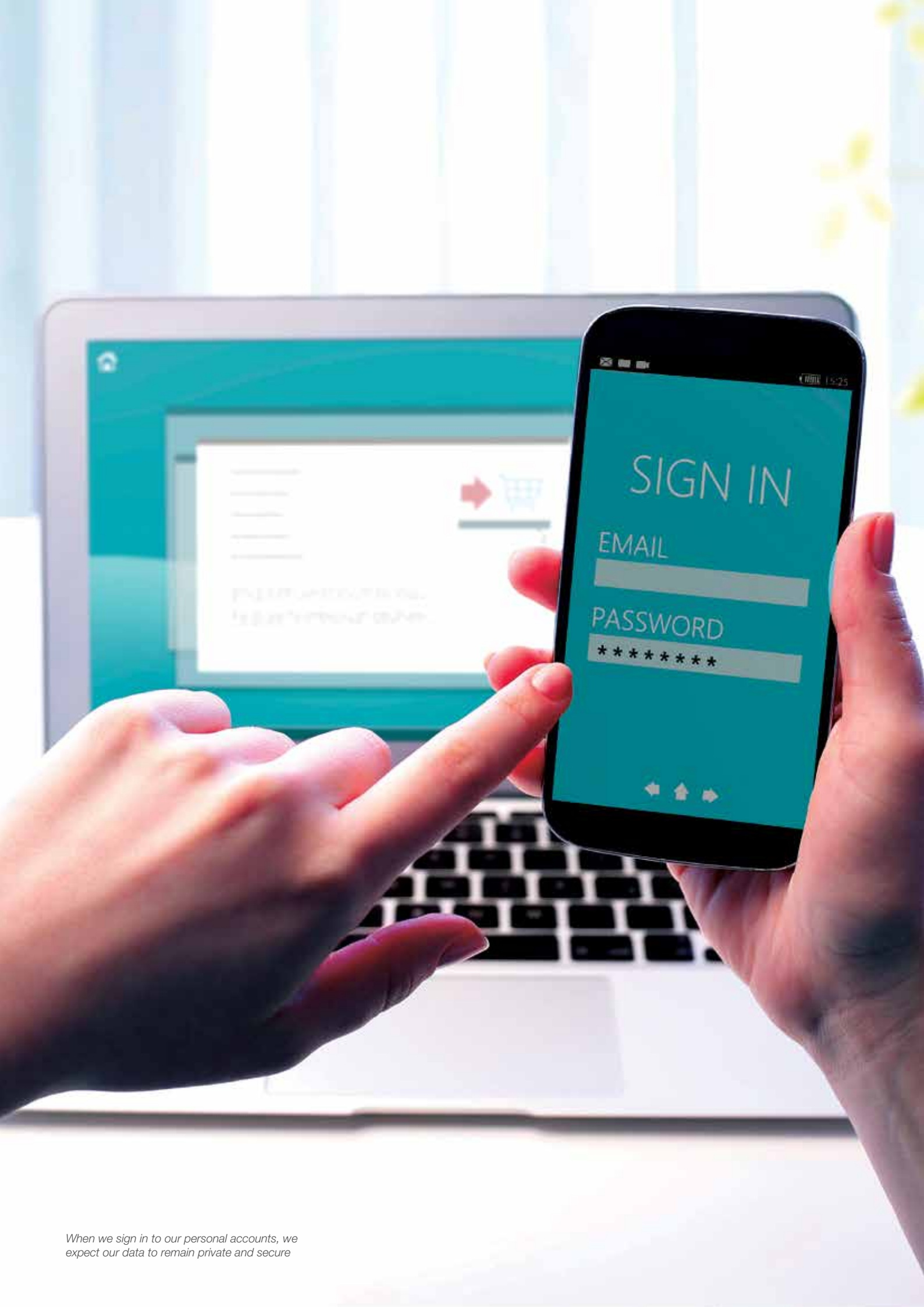
communication devices from 6 GHz to 300 GHz

- JWG 13 is working on a dual IEC/IEEE standard for measurement procedures to determine the specific absorption rate, which calculates the rate at which energy is absorbed by the human body when exposed to a radio frequency electromagnetic field (frequency range of 4 MHz to 10 GHz).

The 2019 technical report covers both 5G base stations and small cells. It provides a vital resource for network operators deploying 5G by illustrating test methods and worked examples on 5G trial sites. The report helps stakeholders — including

facility managers, building owners and governments and local communities — to ensure that they are testing their networks and base stations correctly. The benefits are threefold. It demonstrates new testing methods for 5G, improves global consistency and accuracy for base station and small cell tests, and simplifies the implementation of site RF safety assessments through worked examples.

“As 5G advances at a rapid rate and networks are deployed, testing base stations to ensure they meet the radio frequency (RF) exposure standards is an essential step for operators, regulators and the community, providing a reassurance on safety,” said Wood.



*When we sign in to our personal accounts, we expect our data to remain private and secure*



# How secure is your data self?

In our digitalized world, we need to understand, control and ensure data security

By Antoinette Price

In 2019, a day of data includes 500 million tweets, 294 billion emails, four terabytes produced by a connected car, 65 billion messages sent over WhatsApp and two billion minutes of voice and video calls made, five billion searches and 95 million photos and videos shared on Instagram, according to research by Raconteur data journalism specialists. By 2020 it is expected that wearable devices will produce 28 petabytes (1000<sup>5</sup> bytes) of data.

This is the tip of the ice berg. Every time we shop online, reserve a ticket or make a financial transaction, data is generated. Additionally, smart services for homes, businesses, manufacturing and governments require sharing masses of personal data between individuals and organizations or individuals and governments.

The amount of data we create will only keep growing. Research by the International Data Corporation (IDC) estimates that by 2021, 75% of enterprise applications will use artificial intelligence (AI). As AI technologies evolve and are used to improve products, services and our lives, we need now to ensure the privacy and security of all our personal data.

## The role of standards

Many questions remain, for instance, how much of our personal data already exists, where is it, who can access it, who is using it and for what purpose? How anonymous is our data, in other words, can we be identified by this data or the different data sets which already exist, if algorithms are able to put this information together? Finally, what recourse is there if the data is used in a way that has negative consequences?

“The issue of how much personal data can be used and in what circumstances is a debate which needs to happen in society.”

One way to protect data is through standardization. IEC and ISO develop international standards for information technology through their joint technical committee (ISO/IEC JTC 1), which covers different aspects of data, including privacy, security and storage. Work is also under way to address ethics and other societal concerns, such as transparency and accountability, as well as bias of data sets for algorithms, which are then used in health, financial and many other applications.

## Interview with Ian Oppermann, Chief Data Scientist and CEO of the NSW Data Analytics Centre

*e-tech* caught up with Ian Oppermann, President of the JTC 1 Strategic Advisory Committee in Australia, to learn about the need to develop international standards for data sharing frameworks.

### What are the main issues with data?

We live in a world where we share data all the time which includes our personal preferences and we like it, provided we don't think there are detrimental outcomes. Social media is a great example, where we connect and share with friends. This is all good, but what if someone uses social media to understand your voting preferences and nudge you in a certain direction?

Would you consent to the authorities monitoring your whereabouts? In order to answer the question, you would need to know why they wanted the information. If it were to improve transport services you may agree; if it were to fine you for jaywalking, you may think twice. The issue of how much personal data can be used and in what circumstances is a debate which needs to happen in society. It will differ from country to country, because of diverse customs and attitudes.

The examples of data sharing are growing by the day and it is complicated. You have to think of the entire data set about you, that is out there, who you shared it with and what they could do with it.

### How could a data sharing framework help?

These issues are so important that JTC 1 has decided to create an advisory group on data usage, which will conduct a study of potential standards for data sharing frameworks. The study would describe factors to consider when sharing data, including identifying concerns relating to data sharing frameworks, existing standards that address these concerns, and any gaps, such as:

- lack of guidance and best practices for data sharing
- why many data custodians remain hesitant to share data (cultural, economic or other reasons)
- privacy, security and safety following concerns raised by advocates as the capability of data analytics increases

The group will cooperate with other IEC and ISO technical committees on definitions and relationships between personal information and personally identifiable information. It will also work with other standards development organizations involved in data sharing framework standardization.

It is really important to distinguish between personal information and personally identifiable information. An example of the former is a person's features, such as hair or eye colour. Personally identifiable information would be the different sets of information about a person, which can uniquely identify that person, if successfully connected together by an algorithm, which can mine masses of separate data sets.



*Ian Oppermann, President of the JTC 1 Strategic Advisory Committee in Australia*

This distinction doesn't exist at the moment and we need to develop a quantifiable measure to describe and assess the risk and potential outcomes of the use of data sets. The data sharing framework would ensure that while we don't know all the possible detrimental outcomes, we should be able to understand one outcome versus another, based on what we choose to do with our data. It would also mean that if we decide to prevent a particular outcome, we would know what not to do.

JTC 1 will also ensure appropriate actions are identified to clearly describe these two very distinct concepts of personal information and personally identifiable information, within the relevant standards developed by its subcommittee for IT security techniques.

### What other steps need to be taken?

The world is changing rapidly. Many factors influence this rate, such as growing urbanization, aging populations and climate change. Digitalization continues to change how we live and work and we will need to adapt much faster to it than we are currently doing.

This couldn't be more true for standards development, which is a consensus-building process that happens over time, through confidence and trust building. However, there may well be parts that need to adapt at much faster rates, in order to keep up with new unforeseen risks and situations that arise as technologies evolve, and for standardization bodies to remain relevant.

At the same time as developing frameworks to define what personal data is and how to best protect it, we also need to think urgently about what we do when things go wrong with our data and we suffer as a consequence. In other words, what happens if someone is wrongfully refused a job or a mortgage because an algorithm was biased, or someone hacks one of our smart appliances? Even if we have rules about what personal data can be gathered, used and stored by organizations, we will need to develop a framework for a non-digital right of redress, to deal with people who don't follow the rules and do bad things with our data.

# How can IEC shape the circular economy?

IEC ACEA and TC 111 take a close look at material efficiency and the circular economy

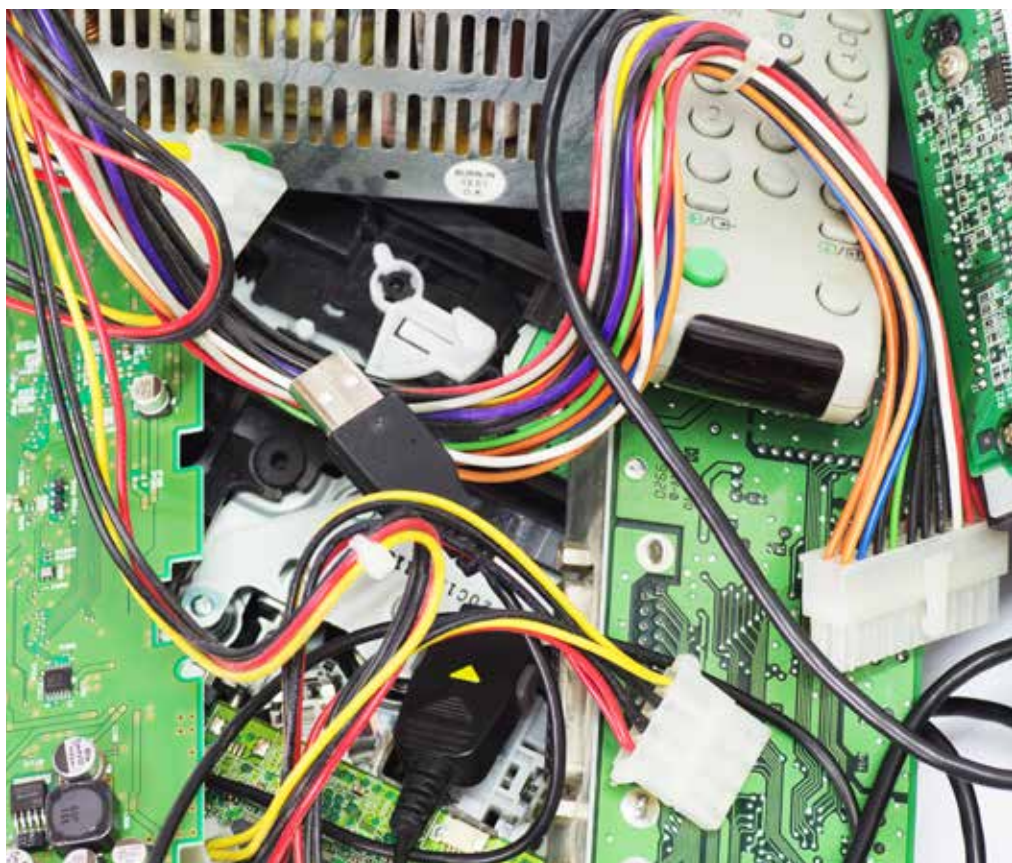
By Natalie Mouyal

From mounting piles of waste to the depletion of natural resources, the current modes of production and consumption are unsustainable. Based on the current linear economic model, products are made, used and discarded. Challenging this linear model, a new economic model, known as the circular economy (CE), is gaining traction.

Within the IEC, the Advisory Committee on environmental aspects (ACEA), which provides guidance to the Standardization Management Board (SMB) on issues related to the environment, and IEC Technical Committee 111, which develops horizontal standards related to environmental issues, are examining the requirements for the circular economy.

## Defining the circular economy and material efficiency

The circular economy calls for a paradigm shift across society in which products, components and materials are viewed as regenerative and restorative. It reassesses how resources are managed and how waste is perceived throughout the entire lifecycle of a product from its initial design to its use, repair, reuse, remanufacture and, finally, its transformation into parts for new products.



*In the current linear economic model, products are made, used and discarded*

According to the Chair of ACEA, Solange Blaszkowski, “the circular economy seeks to encourage the development and use of products that can last longer, be easily repaired and eventually remanufactured”. But, as she notes, “it asks for a business model, reverse logistics and favourable societal and regulatory conditions. You can

develop products that are easy to repair, refurbish or remanufacture, but you also need to have a business model in place on repair, refurbishment or remanufacturing. A reverse cycle is needed so that manufacturers can retrieve products for refurbishing or reusing their components to remanufacture new products. Users



must also be willing to have their products repaired or buy a refurbished one”.

Material efficiency (ME) is an essential part of the circular economy. It consists of the conservation of materials by making products more durable, resource-efficient and facilitates the reuse or recycling of parts at the end of the life. As Blazkowski notes, “the idea of material efficiency is that we cannot keep using up the Earth’s resources because very soon we will run out and we will not have them any more to make new products and new technologies. Therefore, what we need to do is make better use of materials that are currently already in use”.

### Role of standards

Standards can serve as an important tool to promote the circular economy. They can, for example, provide methods to measure the durability or upgradeability

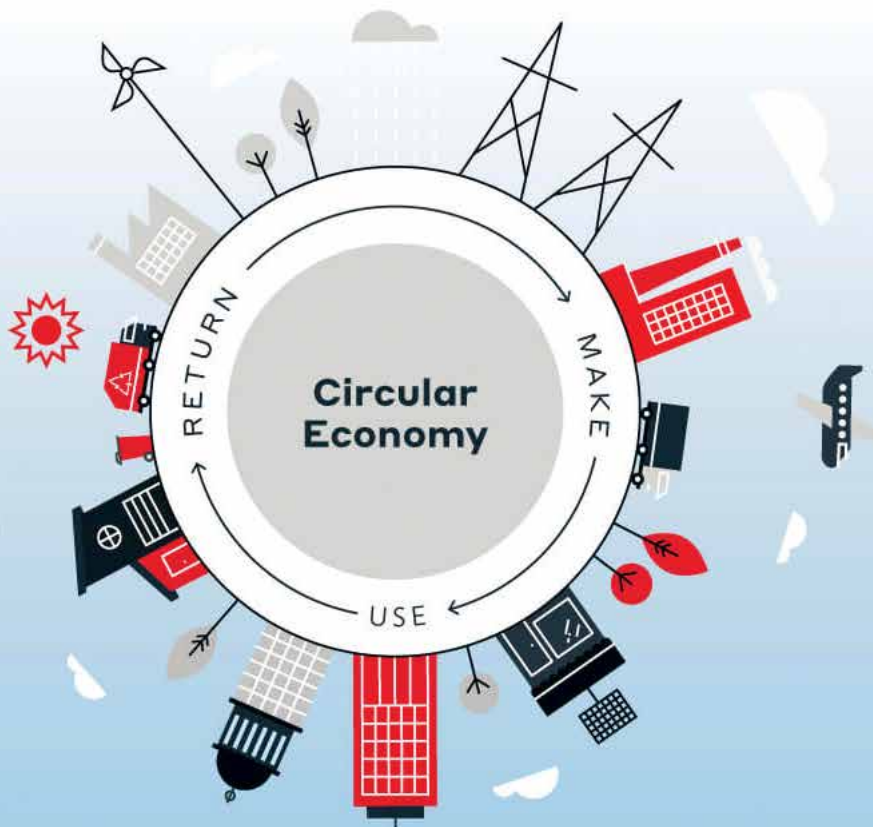
of a product. They can assess the ease with which a product can be repaired or recycled. And, they can ensure the quality of the recycled materials.

Standards must set requirements to guarantee the safety and performance of products, including when, in the future, products will be expected to remain in use for much longer. Issues such as product upgrades and an increased number of repair cycles will need to be addressed. Standards will also need to take into account that products, in the future, will contain increased amounts of recycled material and reused components.

Already, TC 111 has issued several publications related to the environmental impact of electric and electronic equipment. IEC 62430 specifies the requirements and procedures to integrate environmental aspects into the design and development of products as well

as the materials and components from which they are composed. A new edition, developed together with ISO, is expected to be published later this year. While this standard focuses on ecological aspects of the design of products, it does not address material efficiency or the circularity of material usage. Plans for the development of a new standard that includes circularity aspects on environmental conscious design are ongoing.

Two technical reports, IEC TR 62824 and IEC TR 62635, also issued by TC 111, provide guidelines on material efficiency for the ecological design of products and the calculation of recyclability rate for electrical and electronic equipment, respectively. TC 111 has also published standards related to the use of raw materials, most notably IEC 62474 which defines the requirements for reporting the substances and materials used in electronic and electrical products.



However, the IEC is faced with the need to undertake further work. This is the outcome of the survey undertaken by ACEA to understand what guidance the IEC community may need and a study by TC 111 on the status of the circular economy and material efficiency around the world. According to Blaszkowski, “the IEC needs to focus on all aspects of the circular economy, not only to protect the planet but also to protect people and deliver high-performance technology they rely upon”.

### ACEA survey

To better understand the level of knowledge about the concepts of the circular economy and material efficiency, ACEA conducted a survey which was sent to the chairs and secretaries of all IEC technical committees (TCs), sub-committees (SCs) and systems committees (SyC).

Results from the survey demonstrate that certain aspects of the circular economy and material efficiency, such as product design optimization and recyclability, are directly relevant to the work of many TCs/SCs/SyCs, even though this may not always be recognized as such.

It also highlighted the areas where TCs/SCs/SyCs require further support. For example, TCs/SCs/SyCs need to understand how to balance between making products that withstand increased number of repair cycles and contain increased number of reused components while still ensure that they perform well and remain safe. Trade-offs may also be necessary between making products last longer and minimizing their energy consumption. In some cases, repairing a product may not be advisable if the associated costs are greater than the value of the product or have the potential

for causing harm to the person making the repairs.

According to Richard Hughes, a member of ACEA, “committees need to ask themselves how they can best contribute to a circular economy. How can they address the issue of safety within the context of products lasting longer or being made from parts that have been used before? What requirements should be put in place for products that are repaired or remanufactured? These issues will need to be addressed as part of the circular economy”.

“The idea of material efficiency is that we cannot keep using up the Earth's resources because very soon we will run out.”

As a next step, ACEA will provide further guidance on issues related to the circular economy and material efficiency. A webinar on these topics will be available later in the year and a workshop is expected to take place during the IEC General Meeting in Shanghai on 19 October 2019.

In addition, as part of its responsibility for updating IEC Guide 109 on the environmental considerations when developing standards, ACEA will extend it to include relevant aspects of the circular economy and material efficiency.

### TC 111 activities

In its role in developing horizontal standards related to environmental issues, TC 111 has begun exploratory work into the circular economy. As a first step, it issued a study report with recommendations on possible standardization activities within TC 111.

The report provided an overview on the status of the circular economy and material efficiency in Japan, China, Europe and Korea with the aim of determining whether harmonization is beneficial at a global level. It focused on the policies in these countries towards 13 issues related to CE and ME including the durability, resource efficiency, reparability and recyclability of products.

According to Christophe Garnier, Chair of TC 111, “this report shows that the circular economy is happening in many parts of the world. It is an area in which we plan to open new work items taking into account the results of the survey as well as any other standardization activities being undertaken so as not to create overlap”.

Because the concept of the circular economy and material efficiency are relatively new, it is not currently well-addressed in standardization. To address this, the report recommends the introduction of a new concept, circularity design, which focuses on material circularity. It recommends the development of a new standard focused on circularity design of electric and electronic equipment. As noted by Garnier, “this is a draft horizontal standard that will put the circularity into environmentally conscious design”.

# Survey results on the circular economy and material efficiency

An interview with Solange Blaszkowski, Chair of IEC ACEA

By Natalie Mouyal

As the topics of the circular economy (CE) and material efficiency (ME) receive greater importance around the world, the Advisory Committee on environmental aspects (ACEA) recently conducted a survey to identify how it could provide guidance to the IEC community on these topics.

The survey consisted of 10 questions sent to technical committees (TCs), subcommittees (SCs) and systems committees (SyC) with a total of 63 responses received. *e-tech* spoke with Solange Blaszkowski, Chair of IEC ACEA for an overview of the survey and its results.

## What was the purpose of the survey?

The survey was issued to identify the level of understanding and relevance of the circular economy and material efficiency by TCs, SCs and SyCs. It was also intended to determine if the committees could distinguish between circular economy and material efficiency. Before explaining CE and ME aspects to the IEC community, we need to know if this is something that needs to be done or whether the committees already have a good understanding of these topics.

## How familiar were the respondents with the terms circular economy and material efficiency?

The survey demonstrated that the majority of respondents indicated that, yes, they are familiar with the circular economy. Nonetheless, 22% is quite a large number of respondents that are not familiar with it at all. Respondents are more familiar with material efficiency, with nearly 80% indicating an understanding of this term.

## Did the TCs/SCs/SyCs consider the circular economy and material efficiency to be relevant to their work?

Although the numbers were mixed, many TCs/SCs/SyCs did not see that either the circular economy or material efficiency were relevant to them now or anticipate them becoming relevant in the future. Forty four percent of respondents think that the circular economy is not relevant for them and nearly 40% do not think that material efficiency is relevant to their work.

What aspects of the circular economy and material efficiency do respondents think are most relevant to their work?

In the survey, we listed different aspects of the circular economy and material efficiency to find out which ones were the most relevant to TCs/SCs/SyCs. Respondents



Solange Blaszkowski, Chair of IEC ACEA

selected (in order of importance): reduction in the use of material and product lifetime (both 61%), product design optimized for circularity (59%) and recyclability (57%). Other aspects considered important were use of recycled materials and product repairability.

Respondents identify these topics as relevant to their work but don't necessarily associate them with either the circular economy or material efficiency. Of the 19 TCs/SCs/SyCs that answered "no" to the relevance of CE or ME to their work, 10 could nonetheless identify aspects that were relevant to them. So this seems to be a contradiction.

We also asked if any other topics not on this list should be included. We received some



interesting input such as refurbishment, graphical symbols for product/service related to CE or ME, avionics equipment disposal and electroheating as a possible route for material recycling. This has given us answers in relation to recycling and material use.

In the future, products will need to last much longer, will contain increased amounts of reused parts and will need to be repaired more often if we are to fulfil the objectives of the circular economy. As a result, safety and other aspects will need to be considered and developed.

**Do we know if aspects of the circular economy or material efficiency are already included in the development of standards?**

We asked whether CE or ME aspects are already in standards and we can observe that the majority (67%) say no and do not have plans to include them. But those that responded yes are including topics

such as upgradeability, reuse, end-of-life management and reparability in their standards.

**What conclusions can you draw from the survey?**

We learned a lot with the survey, more than we expected, and I think that the main conclusion is that there is still work to do within the ACEA.

In the final question of the survey, we asked respondents to provide any additional comments and we noticed that there is still some uncertainty regarding the terms circular economy and material efficiency. This is not helped by the fact that geographically, different terms mean the same thing or the same term means different things.

The survey shows that for many TCs/SCs/SyCs, the meaning of the terms CE and ME are not clear to them. For example, 35% of respondents did not find CE and

ME to be relevant but half of them could identify relevant aspects from the list presented in the survey.

Because both CE and ME are not well defined, some committees are not considering aspects that might be relevant for their standards. For example, some might think that either CE or ME are only related to the environment, when actually they could have implications for their standards like safety and performance.

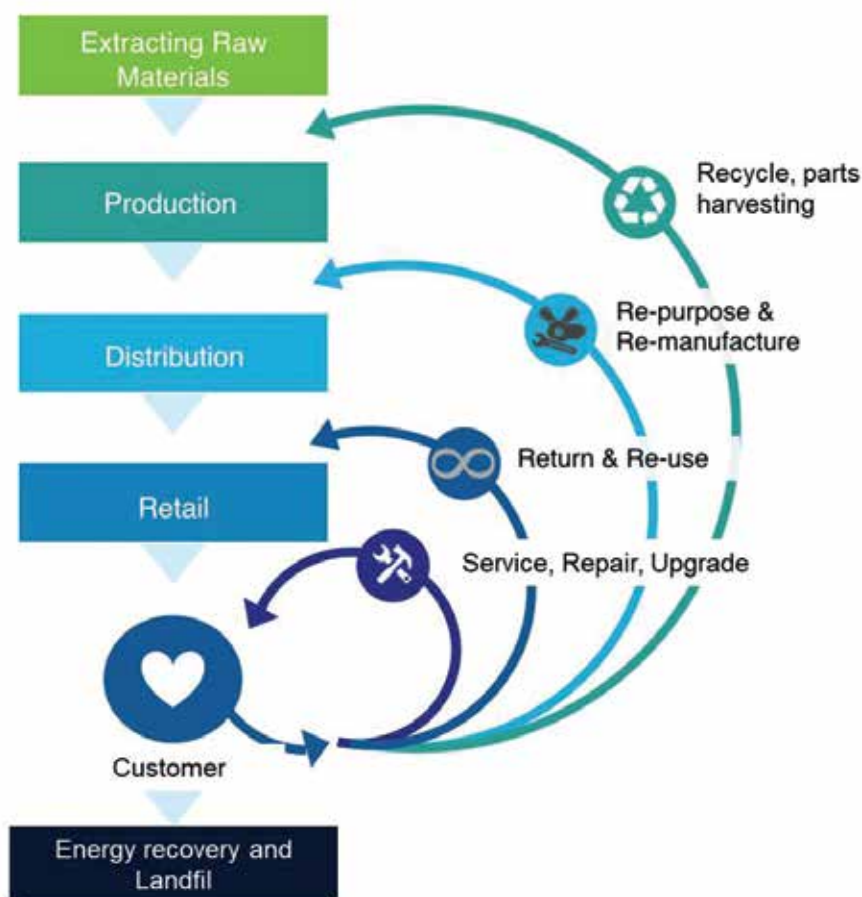
TCs/SCs/SyCs will need to consider issues such as how to balance safety requirements versus reuse/repair requirements. Also, CE and ME aspects can be in conflict with other requirements because making products last a long time could impede the take-up of products offering a lower energy consumption. ACEA stands ready to assist TCs/SCs/SyCs in these matters.

**What are the next steps?**

We will prepare guidance on the circular economy and material efficiency, most likely by revising IEC Guide 109. CE and ME will be important topics to include in this guide. We will start looking into the revisions at our meeting in Geneva in June and develop a timeline for updating the guide. We expect the process to take approximately one year.

We are also planning to organize a workshop on CE and ME during the IEC General Meeting in Shanghai and we have confirmed that we will have a webinar on CE and ME at the end of 2019 or early 2020.

We also will work closely with TC 111 which is now proposing to draft a new horizontal standard on material circulation in environmentally conscious design.



# Virtual reality makes real life even better

Innovative technologies improve business operations and enhance workplace safety

By Antoinette Price

Imagine being able to see the issues of large-scale construction projects before building is complete and to collaborate with engineers and architects to keep on top of changes, or observe a city's infrastructure in real time and improve performance of services.

These and many more scenarios are already possible thanks to a combination of virtual reality (VR) and artificial intelligence (AI) technologies.

## Seeing things in a new light

According to a report by Zion Research, the global VR market is expected to reach USD 26,89 billion by the end of 2022.

The education, healthcare, tourism, and smart manufacturing industries are among those to embrace this technology, which is changing how we work, learn, train and enjoy entertainment.

For instance, some software platforms enable business meetings to be held in VR, replacing traditional, abstract chart and graph presentations. Participants wear VR headsets and immerse into a 3D duplicate or digital twin representation of their business, which combined with data, allows improved risk and performance

monitoring. The virtual presentation offers more accurate ways of looking at business processes and components, for instance in a factory, from an overview level down to the minutest detail. These insights give a much clearer understanding of issues faced and the overall state of operations.

## So how does it work?

Virtual reality is a life-like situation in which people experience and interact within a 3D world that isn't real. This is achieved using a VR headset, which blocks out the real world. This complex technology is comprised of software, which drives components such as displays, sensors, images, maps and tracking technology. These in turn link to the hardware (headsets, smart glasses or helmets).

Displays include monitors and handheld devices such as smartphones and tablets. These contain optical sensors, accelerometers, gyroscopes, GPS and cameras for tracking movement.

360-degree VR, an audio-visual simulation of an altered environment, enables to look in all directions, as is done in real life. It includes live, real-time or pre-recorded footage. When combined with tablet and smartphone apps, users can change their

perspective by tilting and rotating the device, or by touching the screen, which becomes their eyes.

## Interview with Myeong Won Lee, Chair SC 24 for computer graphics, image processing and environmental data representation

*e-tech* caught up on the latest developments in VR standardization with Myeong Won Lee, who leads the work of the IEC and ISO joint technical committee (ISO/IEC JTC 1) and its Subcommittee (SC 24) on computer graphics, image processing and environmental data representation.

Some of the areas covered include:

- Intelligence and information systems which use high resolution imagery formats to support a variety of applications, including modelling and simulation environments, displays and 3D printers and scanners. For instance, a 3D printed heart can be used in preparation for complex surgeries.
- Web and document graphics technologies that utilize 2D and 3D imagery files for presentation and exchange of 3D environments.



VR programmes are used increasingly for education (Photo: <https://www.digitalbodies.net/vr-ar-education-focus-strategic-vision-implementation>)

These incorporate imagery, content concepts and interaction with virtual or synthetic environment applications in modelling and simulation, for example, to reconstruct historic buildings.

- Visual applications in which data captured from the real world is combined with virtual data to produce mixed and augmented reality. For example, during the recent fire at Notre Dame Cathedral in Paris, one news agency enhanced its coverage by using an interactive 3D experience with its app, which displayed the building as it appeared before it caught fire.
- Visualization technology and architecture for developing applications are used in systems

integration areas such as smart cities, for planning purposes, virtual training to prepare first responders for different emergency situations, wearable devices and 3D representation related to healthcare services.

#### **What are some of the key SC 24 standards and where are they used?**

The standards can be used in all areas, where 3D visualization is necessary. For example, virtual military training requires the implementation of 3D scene simulation. For sports, we need 3D simulation of a human character. For education purposes, we need a standardized 3D representation model that can be used interchangeably and a standardized 3D data format.

We also see many 3D applications in entertainment.

ISO/IEC 19775-1 Extensible 3D (X3D) is a 3D file format that can be used for generating and exchanging 3D scenes in heterogeneous computing environments for VR and AR applications. Because X3D is defined with XML, X3D is suitable for transferring 3D objects and scenes between VR and AR applications. X3D can be used for smart city visualization and navigation.

ISO/IEC 19774-1 Humanoid animation (H-Anim) architecture, defines the hierarchical structure of a human body with joint and segment relationships. It also includes different levels of detail of the human body, such as articulation. This





Doctors can prepare for surgery using VR (Photo: Arch Virtual)

can be applied in many areas of medical (dentistry and orthopaedics modelling) and health information.

ISO/IEC 19774-2 Humanoid animation (H-Anim) motion data animation, defines a method of generating animation using motion capture data. This model can be used in diverse computing environments.

ISO/IEC 18023 Synthetic Environment Data Representation and Interchange Specification (SEDRIS) can be used to generate 3D environments with semantic information. SEDRIS defines all environmental data necessary in a 3D environment when implementing VR and AR applications.

### What are some of the key projects in 2019?

This year we are completing a White Paper with guidelines for developing virtual education and training systems. It defines three basic concepts: information

modelling architecture, standards-based functional components, and implementation components. This systematic approach provides a method of developing standards-based systems.

“Our work in the area of systems integration visualization (SIV) is important because it can apply to many areas including education, smart cities, and healthcare.”

Additionally, our work in the area of systems integration visualization (SIV) is important because it can apply to many areas including education, smart cities, and healthcare. We would like to extend the scope to 3D visualization for systems integration areas. The guidelines we have produced for virtual education and training could be applied in other areas which will need their own. We plan to go forward with VR and AR-based ICT integration systems.

Finally, JTC 1 has established an advisory group on use cases for VR and AR-based ICT integration systems. Detailed use cases will be developed for education and training in some areas such as school, medicine, health, and heavy equipment. We plan to propose several new work items for standards about 3D smart city, 3D virtual training systems, and 3D health information.

### Looking ahead

Lee concludes that it is important to work with other JTC 1 subcommittees developing standards related to security, communication, transmission and exchange of information across diverse computing environments and systems, learning, education and training, artificial intelligence, health informatics, and to get them involved in the implementation of integrated systems.

# Moving data around the network

Data networking is at the centre of current digital trends

By Natalie Mouyal

The digitalization of information is underway. It is enabling the use of data to better understand our preferences and provide us with the services that match our needs. At home, the data collected and analyzed ensures that the preferred room temperature is calibrated depending on the occupancy and time of day. Farm animals are monitored from afar to provide the correct quantities of food and water for consumption and guard against illnesses. Manufacturers rely on digital twins to enhance their production capabilities and predict glitches before they occur. Information is being gathered, analyzed and applied to improve experiences in all parts of our lives.

This utilization of data is driving such trends as smart cities, smart buildings and smart manufacturing. It relies on new technologies such as the Internet of Things (IoT) to gather the data, cloud computing to store the data and machine learning to analyze it. But these new technologies, and their successful implementation, are only possible if they can provide high levels of performance and reliability, interoperability and flexibility for future applications.

Data networking is the one common thread throughout these digital trends. Regardless of whether the network is cabled or wireless, collected data needs to be carried through networks to be

analyzed and dispatched. The work to standardize the interfaces and generic cabling necessary for data networking is undertaken by a joint IEC and ISO technical committee, ISO/IEC JTC 1/ SC 25, focusing on the interconnections of IT equipment.

According to Rainer Schmidt, Chair of ISO/IEC JTC 1/SC 25, "People are looking for standards to connect the world. When we speak about IoT, much has to do with bringing information, such as temperature or pressure levels, into a given database or network. To do this and make IoT a reality, you need a clear structure to send to other networks".

## Connecting systems

In homes or offices, systems are increasingly being adopted that connect electrical and electronic equipment. Devices can exchange data and respond accordingly to allow for automatic decision-making. Remote access and user interfaces help manage systems from afar. Protocols are necessary to permit the seamless delivery of services that link homes, businesses and public networks.

The ISO/IEC 14543 series of standards provides the architecture for the home electronic system. It includes standards for the data link layers, protocols for intelligent



Data networking is the common theme connecting current digital trends

grouping and resource sharing as well as remote access system architecture.

However, updates are necessary to ensure that systems accommodate future applications. Schmidt noted that “we are very much interested in IoT. Everyone is speaking about sensors and so we need to introduce sensor upgrades. We also need to address certain aspects of cyber security through robust infrastructure to protect home networks, attached devices and users”.



Rainer Schmidt, Chair of ISO/IEC JTC 1/SC 25

Cables are often used to connect data networking systems. Generic cabling system standards, most notably the ISO/IEC 11801 series, are suitable for a wide range of applications and are designed to support different hardware, including those expected to be adopted in the future.

Updating ISO/IEC 11801 is a priority for Schmidt. He remarked, “this standard is very important because it is the only one defining transmission channels and the limit values on these channels. The defined limit values are used to test or qualify cabling networks and are referenced by many groups such as IEEE”.

Standardizing single pair cabling is a key objective over the next two years. As Schmidt noted, “to develop standards for single pair cabling and make it fit will help to further develop IoT. This is a major aspect of our work”.

The development of standards to connect computer systems and their peripheral devices is another important aspect for data networking since these interfaces ensure interoperability as well as network performance. For JTC 1/SC 25, this includes updates to the standards in the ISO/IEC 14776 series for small computer system interfaces (SCSI) and the fibre channel protocol.

### Saving energy

The multiplication of electronic devices connected to data networks consumes energy. And, as businesses and homes seek to become more energy efficient and reduce costs, it is necessary to find ways to better manage energy usage.

One standard developed by JTC 1/SC 25, ISO/IEC 10192-3, specifies a module to allow the transfer of energy management data between a device and a smart grid using a data network. This allows grid operators to better understand energy demands and improve efficiency. It is a first step towards an interactive system between the smart grid and networked devices.

“People are looking for standards to connect the world.”

According to Schmidt, “the environment is an important area where we can contribute. Currently, we are developing a standard for a system of interacting energy management agents for demand-response energy management. This will allow an efficient information exchange

from homes to energy service provider that will drive smart home development”.

Single pair Ethernet (SPE) with remote powering (i.e. PoDL, power over data line) is another example of how energy costs can be reduced in a data network. By transmitting data and voltage simultaneously, energy costs can be reduced and make batteries in sensors obsolete. Schmidt noted that this is what makes SPE cabling smart.

### Next steps

The scope of JTC 1/SC 25 has been consistent since its establishment in 1989. The standardization of connectivity, cabling and interfaces have been key features of the work of the group. As Schmidt noted, “we develop data networking standards and make them fit for the future. We make sure that they are ready for IoT and industry needs. They are not entirely new work items, but rather developed step-by-step to make them fit for the applications we expect will arise in the next few years”.

All of the big trends affecting homes and industry, from IoT and Big Data to smart manufacturing and smart buildings, have one common driver – data networking. These trends have given new prominence to the work of JTC 1/SC 25.

According to Schmidt, “we are close to the main trends like big data, like integrated industry or industry 4.0 and IoT which are major topics for us. In the next five years, we expect that single-pair cabling, higher bandwidth and technical data security (technical aspects, screening) for data networking will become focus areas for standardization”.



# Standards will make e-scooters safer

New TC to provide standards for personal e-transporters

By Natalie Mouyal

Walking down a city street, pedestrians have recently been confronted by a new phenomenon. Sailing by on sidewalks or bike lanes, commuters have adopted electric scooters as a popular mode of transportation. Offering a convenient means to travel distances considered too far to walk, they eliminate the need to rely on public transportation or a private vehicle. And given that 46% of car traffic consists of distances of less than 5 kilometres, e-scooters could serve as a solution to the increased traffic congestion in many cities.

In the past year, cities have been inundated with electric scooters provided by a vast number of e-scooter sharing services. Offering a convenient and inexpensive access to electric scooters, they have proven popular with city commuters and tourists. And these services have proven so successful that one e-scooter sharing service claims to have reached 26 million riders within the first year. Another was valued at over USD 1 billion within 15 months.

## Hazards lurking

But electric scooters are not without danger. Hospital emergency departments have seen an uptick in the number of injuries caused by the widespread use of e-scooters. According to the medical journal JAMA Network Open, more people were injured while riding standing electric scooters than by riding a bicycle or walking based on a study over a one year period in two Los Angeles emergency rooms.



*E-scooters are a popular mode of transport but not without danger*



*Cities are seeing a rise in the number of e-scooter riders*

Dangers have also been caused by the malfunction of electric scooters. In Zurich, one e-scooter sharing service recalled certain scooters that stopped abruptly during travel, causing injury to riders. And, more traumatically, a passenger train in the Netherlands collided with an electric cart, used to transport school children, after the cart's brakes failed to function properly.

Some issues with electric scooters will be resolved by government regulation. Already, some city governments have begun establishing rules regarding speed limits, designated parking spots and e-scooter travel lanes.

### Standards to the rescue

To ensure safety on a global level, standardization is needed. Currently, few or no standards exist for devices with multiple wheels used for personal mobility or to transport passengers without the use of a steering wheel. Standards are needed to harmonize rules for manufacturers and users as well as ensure the implementation of safety features.

Recognizing the increased prevalence of personal e-transporters and the need to ensure their safety, the IEC has set up a technical committee, TC 125, to provide standardization in the areas of safety and reliability and the protection against hazards. It will also provide standards for docking stations, battery recharging and recycling.

According to Luk Van Hecke, who will serve as assistant secretary to TC 125, "there is a need in the IEC for the work of a technical committee to standardize the evolutions in this market and to guarantee public safety as these devices become more and more common in the public space".

These standards will apply to electrically powered transport devices with one or more wheels where the speed and/or steering is controlled electrically. It includes electric scooters, monocytes and Segways but excludes electric bicycles, motor bikes and cars since they are already addressed by other technical

committees. Standards will only apply for devices used on public roads and spaces.

Issues that TC 125 will address include:

- Terminology for the different personal e-transporters.
- Reliability of the speed control (acceleration and braking) and steering.
- Definitions of the different safety and reliability levels based on the maximum speed of the device and, subsequently, the different safety precautions. For example, should maximum acceleration and deceleration speeds be imposed or should the weight of the user i.e. whether an adult or a child, impact the maximum speed of the device.
- Requirements regarding visibility depending on where the device is used. This can include requirements to use lights, horns or reflectors.
- Protection against hazards such as fire and water.
- Requirements for recharging and public docking stations.
- Methods for testing safety requirements.

Van Hecke noted that "while avoiding all accidents on e-transporters (or any other road vehicle for that matter) is not possible, setting minimum safety standards will help greatly to reduce them. And it could help avoid accidents like in the Netherlands where public safety and the business of a manufacturer were jeopardized".

The secretariat of the new TC will be held by Belgium. The first meeting of TC 125 is scheduled to take place on 23–24 September 2019 in Brussels.

# Under the laser spotlight

IEC Technical Committee 76 prepares safety standards for lasers

By Catherine Bischofberger

Laser technology is so widely used today that we forget that it can be dangerous for our health if it does not meet the strictest safety standards. IEC expertise in producing safety specifications for lasers is recognized by regulators and throughout industry.

## Bright beam of light

Laser technology is used in multiple domains stretching from surgical operations to printing. Lasers produce a very narrow and radiant beam of light. Unlike sunlight, laser light waves have similar lengths and travel together with all their wave peaks lined up, in phase.

Laser is an acronym which stands for light amplification by stimulated emission of radiation. Albert Einstein first theorized about the stimulation of light emission in 1917. He used Planck's law of radiation to describe probability coefficients for stimulated emission of electromagnetic radiation. His theory proposed that electrons could be stimulated into emitting



*Standards specify the height of laser projectors  
(Photo: Wikimedia Commons Fir0002/  
Flagstaffotos)*



light of a particular wavelength. This would become the founding principle of all lasers used today even if it took another 40 years or so before scientists were able to come up with a functional device.

While laser technology has enabled huge technical breakthroughs in a wide variety of areas, a number of safety concerns are specific to laser light. Lasers can cause eye injuries to anyone who looks directly into the beam or its reflections from mirror-like surfaces. Moreover, the diffuse reflections from a high power beam can equally cause eye damage. High power lasers can also cause skin damage and ignite flammable materials.

The type of damage and the threshold at which each type of lesion is produced depend on different factors such as exposure time and the absorption properties of the material exposed to laser light.

### IEC global classification of laser products

IEC Technical Committee 76: Optical radiation safety and laser equipment, was set up to produce safety standards for lasers as well as LEDs. One of the TC's major endeavours is the publication of IEC 60825-1. This standard offers a global classification scheme of laser products according to their safety requirements and emission limits. It is widely used by industry and is viewed as the reference for laser equipment by manufacturers, installers and regulators in most countries around the world. For instance, the standard specifies the determination of the nominal ocular hazard distance from the laser source. "If you are outside the hazard distance you are safe from accidental exposure. If you are too close and look into the laser beam, there is a real risk of eye injury," explains Jan Daem, an expert

inside IEC TC 76. He is also environmental compliance officer at Barco, one of the leading manufacturers of image projectors used in cinemas. The company notably manufactures laser projectors, which are much more energy efficient than traditional light projectors and are also expected to project a better image on the screen.

IEC 60825-1 is a horizontal publication, meaning that it is generic and provides a global framework for most other IEC TCs which produce standards for specific laser products, such as printers, hair removal devices, barcode scanners, and so on. It ensures that all the standardization documents produced by each TC are coherent.

TC 76 is divided into seven working groups (WGs) which have different scopes. WG 7, for instance, produces standards for high power lasers. Jan Daem is a member of three of these WGs. The TC has published 35 documents and is working on 12 publications, all new editions of existing standards. It works closely with the International Commission on Non-ionizing Radiation Protection (ICNIRP) and the International Commission on Illumination (CIE).

One of the important standards Daem worked on is IEC 62471-5, which applies to image projectors. "We took three years to publish this document, starting from scratch. We got people from industry to work together and we started first by evaluating scientific data. Following that, we proposed a pragmatic way of measuring conditions for image projectors based on the end user's exposure," he explains.

### Boon for industry

Being involved in standardization work brings huge benefits for his company as



IEC TC 76 expert Jan Daem

well, according to Daem. "It is a great help: we have the heads up about any changes in standardization, which means we don't need to redesign any of our products for them to be compliant. The communication with our in-house validation and design team is much easier. The whole design process is better streamlined all the way to market launch."

Daem is also keen to emphasize the welcoming working atmosphere inside IEC TC 76. "Many of the members are total experts who have been working in the field for 30 years. They were all incredibly helpful when I joined and I learnt a lot working with them. There was a great amount of guidance. The TC is very open to scientific and technology advances, as well as accepting and integrating these changes into the standards."

The time consumed working in standardization not only serves a purpose for the community at large – it also helps the manufacturers involved to be better prepared to meet market requirements.

# Optimizing Ex skills

## Personnel certification: a success story for IECEx and one of its partners in Norway

By Claire Marchand

Safety and health in the workplace, also known as occupational safety, can be traced back to the first industrial revolution when factory owners began to consider it as a labour-related issue. The Factory Acts of 1802, introduced out of concerns about the poor health of children working in textile mills, marks the beginning of health and safety regulation. Things have changed drastically since then and most countries around the world have enacted laws to protect their workforce, albeit with varying degrees of stringency.

### Safer equipment, ongoing training

As defined by the World Health Organization (WHO) “occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards.”

Technological advances and automation have made the workplace safer. Industrial robots for instance can lift much heavier loads and perform many of the dangerous tasks previously assigned to humans. But safety at work entails much more than safer machinery. Worker skills are at stake as well.

The rapid pace of technological innovations requires workers to adapt constantly and develop new skills. The



need for continuous training had increased with the acceleration of digitalization in most business processes. Companies invest huge amounts of money not only in their equipment but also when they hire staff. Providing ongoing training that keeps their workforce up to date on new technologies and processes relevant to their jobs is a good way to maximize their investment. This is true for all industry and service sectors.

### Why is training so important?

This is even truer for the Ex industry. Ex, which stands for explosive, includes sectors such as oil and gas, mining, petrochemical, pharmaceutical, food processing, sugar and methanol refineries, printing, paper and textiles, and many more – the list is by no means exhaustive.

Safety in hazardous areas is non-negotiable. When equipment is not installed, maintained, inspected or repaired by competent persons and according to strict Ex standards, the outcome can be devastating. What may be tolerable in non-explosive atmospheres can lead directly to explosions and/or fires in hazardous locations, not only destroying property but also costing human lives and causing severe injuries.

### Certification of personnel competence

Ex industry workers' skills and competence are of the utmost importance. To meet Ex industry's needs and ensure that all safety aspects have been covered, IECEx, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres, launched the IECEx scheme for certification of personnel competence (CoPC) in early 2010.

The scheme provides companies working in the Ex field with independent proof that

a person has the required competence and capability (based on qualifications, experience and demonstrated ability) to implement the international Ex standards and to work on, or repair, equipment located in hazardous areas. This can be especially important for consultants and contracted staff. The IECEx CoPC is personal, non-transferable and valid across international borders. As well as the certificate itself, IECEx-approved personnel are also furnished with a wallet-sized identification card with photo, providing instant proof of certification.

The scheme for certification of personnel competence complements the other IECEx schemes – IECEx certified equipment scheme and IECEx certified service facilities scheme – to ensure that equipment and people working in the Ex field operate in the safest possible conditions.

### A case study in personnel certification

Ex certification bodies (ExCBs) are the driving force behind all IECEx schemes and they certainly helped make the scheme for certification of personnel competence a success. According to IECEx Executive Secretary Chris Agius, "the objective of the scheme is to make the world a safer place and to use the principles of conformity assessment to provide employers and others with the confidence that the personnel working in or near hazardous areas containing explosive atmospheres have been independently certified as competent to do so according to world's best practice requirements. The ExCBs are essential partners of the IEC and IECEx and providers to industry in this endeavour. Local presence and availability of active and future ExCBs in the market place is crucial in order to grow the scheme."

In Norway, one ExCB, Trainer Certification, has particularly excelled in promoting the scheme and making it a success story: The company started looking into the scheme in 2014 and four years later, it had the highest number of personnel certifications among all ExCBs. Its Managing Director, Einar Thorén, is convinced that "with an increased focus on standards and certification schemes, this is just the beginning." He adds that the company expects significant additional certification at all of its locations in the years to come and emphasizes that some companies are signaling a need for certification of up to 50 000 people. "When they knock on the door, we'll be ready" says Thorén.

To make this rapid development possible, Trainer has assured quality and affiliated with international partners that organize CoPC exams for local candidates on behalf of the Norwegian company. In all cases, Trainer issues and marks all exams and makes the final certification decision.

As Thorén says: "It is our goal to make the IECEx scheme for certification of personnel competence a standard in all countries. That would make it easier, safer and cheaper for everyone in the industry."

Find out more: [www.iecex.com](http://www.iecex.com)  
[www.trainor.no](http://www.trainor.no)



# Peer assessment programme enhances global certification scheme

## Fostering mutual trust and recognition

By Antoinette Price

From household appliances to office equipment and medical devices, when we purchase electronic products, we expect them to function properly and to be able to use them safely. We assume that this has been taken care of through the process of testing and certification. But how can we be sure that the people carrying out the tests are doing their jobs correctly?

### Testing the testers

IECEE is the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components. The different schemes test the safety, quality, efficiency and overall performance of electrical and electronic components, devices and equipment for homes, offices, workshops and health facilities, to ensure they comply with international standards such as those published by IEC.

IECEE covers 23 categories, including batteries, cables and cords, electric vehicles, lighting, photovoltaics and portable tools.

A core part of the Conformity Assessment Board (CAB) policy for IEC, and IECEE work, is the peer assessment programme, which allows new participants to become qualified and existing participants to



*IECEE peer assessment programme enables participants to be assessed by experts working in the same market segment*

maintain their qualifications; without it, they cannot operate within IECEE.

“Peer assessment offers the unique opportunity to understand how, and with which level of competence, other participants in the system operate, and to be assessed by true experts working in the same segment of the market”, said Wolfram Zeitz, Deputy Secretary of IECEE.

Peer assessment of the participants ensures that national certification bodies (NCBs), CB testing laboratories (CBTLs) and other laboratories operating in the IECEE System competently carry out

the testing, by applying the standard's requirements and the rules of the system consistently.

### IECEE peer assessment programme

The programme aims to ensure:

- conformity of member organizations with specified requirements
- equivalence of test and assessment results generated by the members
- acceptance (mutual recognition) of the results from one member, by all other members.

In 2018, the *IECEE Lead and technical assessor training* was held in the US. Training contributes towards harmonizing processes and helps to foster mutual trust and recognition of NCBs and CBTLs. The training ensured that newly appointed assessors understood the need to assess the particular rules of the system, and to help existing assessors reach the next level of expertise. More training is expected to take place in Europe in 2019, followed by Asia in 2020, to ensure harmonized interpretations among our pool of more than 500 peer assessors.

# Smart made safe

## Trust in consumer electronics, healthcare devices through IECQ testing and certification

By Claire Marchand

In the last decade the healthcare sector, which had until then been mainly in the hands of professionals, has seen a major shift. People now keep tabs on their diet, activity and health with the help of dedicated smart devices and apps. Home healthcare devices and equipment allow patients with chronic conditions to monitor and share their vitals with clinicians on a regular basis.

### Consumers are taking charge of their health

Technological advances in the workplace and at home have made people's life easier in many ways but have also made them more sedentary than ever before. The lack of physical activity, coupled with unhealthy eating behaviours – processed, ready-to-eat foods became a staple of the 1980s and 1990s – had dire health consequences, mainly in industrialized countries, where an ever increasing number of people were overweight. In the late 1990s, people began to realize the error of their ways, turned increasingly to organic food and started to take better care of their health and wellbeing. The advent of smart consumer electronic devices since the mid-2000s and the proliferation of health and fitness content through websites, apps and social media posts have helped them in their quest.

The health and fitness industry has seen an unprecedented growth in recent years and the demand for smart devices and smart apparel keeps growing at a rapid pace.

Watches not only give you the time but also count the number of steps you take in one day and measure your heart beat. Scales don't just tell you how much you weigh, they add your body mass index (BMI), percentage of bone and muscle mass or body water, body fat; in some cases, they even provide you with weather forecast for the day! Smart apparel can track the speed, distance and acceleration of a runner, muscle activity, calorie burn and/or other biometrics. Bluetooth connectivity in a jacket allows the wearer to access online music or navigate sites by just touching a sleeve. Smart fabric may not yet be mainstream but it's getting there.

Since all data collected by smart devices and apparel are transmitted wirelessly to a mobile device via dedicated apps, people can keep track of their performance and progress over time.

### Home patient monitoring

While technological advances have changed the life and behaviours of health-conscious people, who can take better care of themselves with the help of smart

devices, they have also hugely benefitted the medical sector.

Technological innovations have modified the doctor-patient relationship. Today, doctors can provide – as they once did, many years ago, when they still made home visits – diagnosis, monitoring and treatment in patients' homes, thanks to the development of medical equipment and products specifically designed for in-home use.

In a not so distant past, a doctor appointment – or at least a visit to a chemist – was necessary to have one's blood pressure measured. The advent of electronic devices in the second half of the 20th century changed behaviours, allowing people to monitor it at home. The same goes for blood sugar levels: electronic home glucose meters were on the market in the early 1980s, allowing people with diabetes to check the concentration of glucose in their blood several times a day.

Heavier treatments, such as dialyses, can now also be performed at home. While in the past patients had to block time and go to a specialized facility to receive therapy, they can now use home dialysis equipment, thus reducing the costs of therapy and increasing their personal comfort.

And again, all measurements made by wearable or home monitoring systems are relayed to clinicians who can detect any abnormal readings and request patients to come to the clinic or practice for adequate treatment.

### No smart device without sensors

These technological innovations and advances wouldn't have been possible without sensors. They have played a major role in the development of the sophisticated and extremely accurate equipment installed in medical centres, and are obviously key in the in-home and wearable devices that are increasingly used by patients throughout the world.

Sensors come in many shapes and forms: vision, flow, fibre optic, gas, motion, image, colour, light, pressure, infrared, photoelectric and so on. They are a key underpinning technology for a wide range of applications. In medical equipment for instance, pressure, temperature and force sensors monitor critical parameters in dialysis equipment. For fall and activity tracking, sensitive pressure sensors

can identify small changes in altitude and differentiate between vertical and horizontal positions or count the number of steps in a given day. Bedridden patient monitoring for activity, respiration and movement is done using piezo film sensing technology.

Sensor technology is advancing rapidly meaning that further intelligence can be integrated into medical devices, making them more sophisticated and at the same time more user-friendly.

### IECQ: safety, reliability and cost-effectiveness

Even more so than in other sectors, the sensors used in medical equipment need to be extremely high-quality, reliable and accurate. Defective components are not an option since people's lives are at stake. Sensor manufacturers and suppliers all over the world have a powerful tool at their disposal, enabling their products to meet the strictest requirements: IECQ testing and certification. IECQ, the IEC Quality Assessment System for Electronic Components was established

in the early 1970s. The System has grown with, and adapted to the technological developments in the electronics industry.

IECQ provides industry with a supply chain verification tool for seeking assurance that electronic components, assemblies, processes and related materials conform to declared technical standards and specifications.

In addition, there is a multitude of related materials and processes that are covered by the IECQ Schemes. IECQ certificates are used worldwide as a tool to monitor and control the manufacturing supply chain, thus helping to reduce costs and time to market, and eliminating the need for multiple re-assessments of suppliers.

IECQ operates industry specific Certification Schemes:

- IECQ AP (Approved Process)
  - IECQ AP-CAP (Counterfeit Avoidance Programme)
- IECQ AC (Approved Component)– IECQ AC-AQP (Automotive Qualification Programme)
  - IECQ Scheme for LED Lighting (LED components, assemblies and systems)
  - IECQ AC-TC (Technology Certification)
- IECQ Avionics – IECQ ADHP (Aerospace, Defense, and High Performance)
- IECQ HSPM (Hazardous Substances Process Management)
- IECQ ITL (Independent Testing Laboratory)

In brief, IECQ is an essential player and a key partner of industry in the development of safe, reliable and accurate medical devices and equipment.

Find out more: [www.iecq.org](http://www.iecq.org)



People can monitor their blood pressure at home (Photo: Qardio)



# IEC signs Gender Responsive Standards Declaration

## Women have major role to play in standards development

By Claire Marchand

The opening ceremony for the Declaration on Gender Responsive Standards and Standards Development took place on 14 May 2019 at the Palais des Nations in Geneva, Switzerland. IEC is one of its signatories.



IEC General Secretary & CEO Frans Vreeswijk signing the Declaration for Gender Responsive Standards

IEC General Secretary and CEO Frans Vreeswijk, who couldn't attend, signed the declaration in advance and sent a video message.

In his address, Vreeswijk said: "I believe gender diversity in standardization is important because different perspectives make technology solutions more relevant

to all of society. I am delighted to sign the declaration on gender responsive standards and call on engineers and scientists everywhere to encourage more girls and women to choose professions in science, technology, engineering and mathematics."

### Diversity as a first step towards equality

Gabriela Ehrlich, IEC Global Head Public Affairs & Advocacy, represented the IEC at the signing ceremony. As such, she participated in a panel session on the role of women in standards development. She stated that when women participate in standardization, they bring their own expertise and experience which increases know-how and adds value to the groups.

Ehrlich explained that electrotechnical standardization work is highly specialized; standards are developed by technical experts for technical experts. To reach greater gender diversity raises the issue of girls' education in science, technology, engineering and mathematics (STEM). Ehrlich said: "To have diversity and later, hopefully, equality in standardization, we really need to strongly encourage girls and young women to study and take up positions in STEM fields. And we're not

talking of the token woman here and there. The system has to change in a big way with men in positions of power supporting and driving this move. Only then will we be able to achieve gender diversity/equality."



## SDG 5: promoting gender equality

Gender inequalities are still deep-rooted in society but actions are undertaken throughout the world to reduce and ultimately eliminate discrimination against women and girls. As part of its Sustainable Development Goals (SDGs), the United Nations has put forward SDG 5 which aims to achieve gender equality and empower women and girls by 2030.

In the field of standardization, still very much a man's world, the United Nations Economic Commission for Europe (UNECE) initiated the Gender Responsive Standards initiative in response to a mandate by the Working Party on Regulatory Cooperation and Standardization Policies (WP.6).

The Gender Responsive Standards initiative drafted the Declaration for

Gender Responsive Standards and Standards Development, which invites all standards bodies to pledge to make the standards they develop and the standards development process they use gender responsive by:

- signing the Gender Responsive Standards and Standards Development Declaration
- creating and proactively implementing a gender action plan for their organization and
- tracking progress, collecting and sharing data, success stories and good practices

By signing the declaration, standards bodies demonstrate their commitment to gender equality and enhancing the contribution of voluntary standards to the achievement of the 2030 agenda on sustainable development.

## Strong commitment from the IEC

In 2016, Frans Vreeswijk accepted for the IEC to participate in the International Gender Champions initiative. The initiative is an international network of senior leaders working to advance gender equality in the executive management of their institutions and their programmatic work, through concrete and measurable commitments. In this context, Vreeswijk's role is to motivate IEC Members to encourage the participation of more qualified women experts in IEC technical work and encourage technical committees to consider a gender-balanced approach in all relevant IEC International Standards and send more women to the Young Professionals programme.



*Signatories are expected to proactively implement a gender action plan for their organization*

# Keeping food cool

IEC Standards for refrigerating appliances combine safety, efficiency and environmental protection

By Natalie Mouyal

*Bananas from Guatemala and beef from Argentina were once considered exotic delicacies to Europeans and North Americans. But how was it possible to transport such foodstuff from one port to another without having it spoil during the journey?*

The solution was devised by the French engineer Charles Tellier who fitted the first ship with a refrigeration system that allowed meat to remain fresh during its 105 day journey between France and Argentina in 1876. Refrigerated shipping emerged and, by 1902, 460 refrigerated ships, or “reefers” as they were also known, transporting millions of tonnes of Argentina’s beef and Guatemalan bananas.

From producer to consumer, food must be kept at low temperatures to prevent spoilage and slow the growth of harmful bacteria. A reliable cold chain begins the moment food is harvested through to the processing and packaging of the product until it reaches the retailer and, finally, the consumer. Throughout the process, food must be kept cold, including during its transportation and storage.

The International Institute of Refrigeration (IIR) estimates that about 400 million tonnes of food are preserved using refrigeration

worldwide and over two billion refrigeration units - commercial and in homes - are in use. But more effort is needed. According to the Food and Agricultural Organization (FAO), approximately 1,3 billion tonnes of food is wasted or lost each year. In developing countries, loss is often the result of technical constraints such as the lack of an uninterrupted cold chain.

A reliable cold chain is necessary to achieve food security and end food waste in many parts of the world. Many IEC Standards help to promote the United Nations’ Sustainable Development Goals (SDG), the standards related to cooling and refrigeration. They are essential to helping countries achieve SDG 2 on ending hunger.

## The need for refrigerants

Refrigeration can be defined as the lowering of the temperature in an enclosed space by removing the heat from the space and transferring it elsewhere. However, heat will not spontaneously move from a colder location to a hotter one. Liquid refrigerants are necessary to absorb and remove the heat from the space.

Refrigerants have a key role on the performance of the refrigeration cycle. However, some of the most commonly used refrigerants contain chlorine

which, when released into the earth’s stratosphere, cause harm to the ozone layer.

Worldwide efforts to reduce the use of substances responsible for depleting the ozone layer led to the adoption of the Montreal Protocol in 1987. Considered by some to be one of the most successful international agreements, the Montreal Protocol has allowed the ozone hole in Antarctica to become smaller. However, the Protocol also led to the replacement of certain substances with hydrofluorocarbons (HFCs) that may not damage the ozone layer but are considered greenhouse gases with the potential to cause global warming.

The Kigali amendment to the Montreal Protocol, which entered into force on 1 January 2019, requires countries to phase out the use of HFCs by more than 80% over the next 30 years. Low global warming potential (GWP) alternatives, so called natural refrigerants (carbon dioxide, ammonia and hydrocarbons), as well as unsaturated HFCs, are possible replacements to the presently used HFCs.

However, apart from carbon dioxide, most of the low GWP alternatives are significantly more flammable than HFCs.





The newly updated IEC Standard applies to commercial refrigerators (Photo: Keven Phillips, Pixabay)

### IEC Standards ensure safety and efficiency

IEC Standards ensure, among other things, that products meet certain safety requirements. IEC Technical Committee 61 prepares standards on the safety of household electrical appliances, including for refrigeration. Its subcommittee, SC 61C prepares international safety standards for refrigerators, freezers and similar appliances used in homes, supermarkets, hospitals, transportation, manufacturing, etc.

SC 61C has recently updated the standard IEC 60335-2-89, which provides the requirements for commercial refrigerating appliances and ice-makers. The new edition allows for an increase in the maximum charge size permitted

for flammable refrigerants used in certain types of commercial refrigerating appliances from the currently permitted 150 grams to approximately 500 grams in case of A3 class (hydrocarbons) and to 1,2 kg for A2L safety class refrigerants according to the flammability classification based on the standard ISO 817.

According to Marek Zgliczynski, Chair of SC 61C, “the standard allows manufacturers to comply with present and future regulations of phasing out refrigerants with a high global warming potential for this market segment”. This includes most notably the large, commercial display cases used in supermarkets.

Other IEC Standards are also essential in ensuring the safety of refrigerating

appliances. Most notably, a number of standards in the IEC 60335 series address the safety requirements for various types of appliances using refrigerants. For example, IEC 60335-2-104 provides the requirements for the recovery and/or recycling of refrigerants.

IEC SC 59M addresses the performance requirements of electrical household cooling and freezing appliances such as refrigerators and food freezers. In an attempt to measure the energy efficiency of household refrigerators, SC 59M issued IEC Technical Report 63061 which provides a uniform method for calculating the parameters of adjusted volume in refrigerating appliances. Performance testing methods for commercial appliances are covered by relevant ISO standards.



# Energy efficient standards for offshore units

## Revamp of IEC 61892 series

By Catherine Bischofberger

IEC Technical Committee 18: Electrical Installations for ships and of mobile and fixed offshore units, has published a major revision of the IEC 61892 series of standards, key documents for the safety of offshore platforms, recognized by industry and legislators worldwide.

### No voltage limitations

The IEC 61892 series of standards is an essential set of specifications for the offshore oil industry, also applicable to other sectors such as offshore wind systems. The series has been thoroughly brought up-to-date to take into account rapid technology changes in offshore

platform electrical and electrotechnical technology, such as increased automation and the growing use of alternative sources of energy. “One of the major changes with the previous series is that we did not include any electricity voltage limitations in these standards, either for alternating current (AC) or direct current (DC). This enables platforms to be further from



the shore or interconnected, via sub-sea cables,” explains Geir Bull-Njaa, the convener of the IEC maintenance team which worked on the revision (MT 18).

The standards were revised with help from industry. “We have several members from the manufacturing sector in our team, including one expert from a major producer of electrical equipment and systems who gave us a lot of information on market requirements. We also had someone who was very aware of International Maritime Organization (IMO) requirements because he works for one of the most important operators of mobile offshore platforms”.

### Specifications for energy efficiency

Environmental preservation aspects were also taken into account. “Even if they are not environmental standards per se, we were keen for the IEC 61892 series to help limit the impact of offshore platforms

on the environment,” he says. In effect, a number of energy efficiency requirements are made in IEC 61892-1, the first standard of the series which specifies general requirements and conditions for mobile and fixed offshore units, some of which were not in the previous edition. They include the efficient use of generated power, the use of high efficiency motors and variable speed drives to optimize power consumption, the use of low-loss transformers and other high-power equipment, the re-use of lighting fixtures with high efficiency long-life lamps, energy optimization through the use of brake energy or waste heat recovery, as well as the establishment of an energy management system.

Renewable energy sources are also specified in one of the standards (IEC 61892-2) as they can be used to power small offshore units with low electrical consumption. Renewable sources include photovoltaic cells and wind generators, microturbines, closed cycle vapour turbines or thermoelectric generators.

The maintenance team worked closely with IEC Technical Committee 31: Equipment for explosive atmospheres. “We consulted TC 31, especially for IEC 61892-7 which deals with hazardous areas. The expertise of its members was most useful,” says Bull-Njaa.

Other IEC TCs were kept informed, such as IEC TC 99 which specifies standards for high voltage installations and IEC TC 64, which prepares standards for commercial installations. “We also liaised with IEC TC 88: Wind energy generation systems, because we did not want to infringe on their area of standardization.”



*Geir Bull-Njaa, Convener, IEC TC 18/MT 18*

### Future developments and need for new recruits

While the revised series includes seven standards, new publications or amendments to existing publications are likely to complete the list in the near future. “There is probably a requirement for a standard on batteries for offshore installations. New installations can now be powered by hybrid power plants combining big battery packs with diesel or turbine driven generators for instance. Technology is moving very fast and we are keeping abreast of the most recent developments”.

The TC would also like to recruit new experts. “We are always on the look-out. We need good general purpose electrical engineers, but with a systems outlook,” he adds. New blood is needed to meet the technology challenges of our time and keep on improving IEC TC 18 standards so that they remain a global reference for the maritime and offshore industries, as recognized by the IMO and other regulatory bodies.

*Offshore platforms need to be safe*





# The year in review

This issue looks at some of the key themes of standardization and conformity assessment activities since the IEC GM in Busan, Korea in October 2018. It will cover committee work in diverse areas including the circular economy, renewable energy certification, and the impact of artificial intelligence technologies on our lives, business and industry. It will also examine how international standards contribute to achieving a number of the UN SDGs.









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