

TRANSPORTATION

TECHNOLOGY FOCUS

Maglev high-speed trains

New trends in urban transport

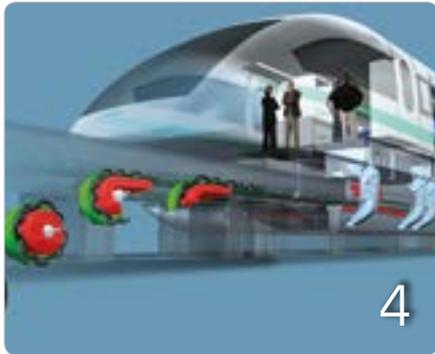
Formula E on the starting grid

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Transportation

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Smarter, safer transportation for all

IEC standardization and conformity assessment work essential to modern transportation modes



Claire Marchand
Managing Editor e-tech

Issue 02/2014 of e-tech focuses on transportation, from the role of the IEC in the automotive industry to new modes of urban transportation and maglev (magnetic levitation) high-speed trains. Smart transport and traffic management are also covered. And last but not least, light and heavy-duty industrial vehicles, an important segment of the automotive industry that is undergoing many developments with the emergence of electric vehicles.

Motor vehicles, whether they are EVs (electric vehicles), hybrids or powered by internal combustion engines, contain an ever growing number of electric and electronic parts. Consequently the role played by the IEC becomes more important as well. Through its standardization and conformity assessment work, the Commission ensures that electrical equipment and electronic components used in these vehicles are of the highest quality and reliability and help make cars safer and ever more energy-efficient.

Another type of EV will be featured in this issue: electric racing cars. Formula E is a new FIA (International Automobile Federation) championship and the world's first fully-electric racing series. In the words of its promoters, [the championship] represents a vision for the future of the motor industry over the coming decades, serving as a framework for R&D around the electric vehicle, accelerating general interest in these cars and promoting sustainability.

Away from the glamour of Grand Prix racing but indispensable nonetheless on factory floors, harbours, hangars or warehouses, there are industrial vehicles. The trend for many of those is to go all electric. An article will explain the whys of this development.

Issue 02/2014 will also take a closer look at new modes of urban transportation. With a view to reducing pollution and become more energy-efficient, many cities around the world are developing new public transit networks, such as electric pods or cable cars depending on the terrain, and are encouraging emission-free individual means of transport.



Formula E is a new FIA championship featuring fully-electric racing cars (Photo: Formula E)



PRT (Personal Rapid Transit) System station at the Masdar Institute Campus (Photo: Masdar City)

Maglev – a technology for the future?

Magnetically-levitated trains are running in a small number of countries

Morand Fachot

Railways have constantly improved since they were first introduced. However, they still rely on basically the same principle: train wheels running on steel tracks and causing friction. A technology that sees trains “floating” over a track using magnets and superconductivity may radically change train transport in the future.

Not the end of the line yet

Ever since they were introduced trains have run on rails; currently those are made of steel. Even though rolling stock and rail technologies have greatly improved, allowing

trains to run faster and faster, the mechanical friction between wheels and tracks is considered a factor limiting performance and requiring considerable maintenance of equipment in this well-established mode of transportation.

Magnetically-levitating trains that eliminate mechanical friction by using magnetic suspension (or levitation) are seen as offering an interesting possibility for the future of rail transport. The technology relies on superconducting magnets. Even so, existing networks built over decades are not likely to disappear soon as the few maglev trains functioning now are still mainly in the experimental phase or are running over relatively short distances.

Come fly with magnets

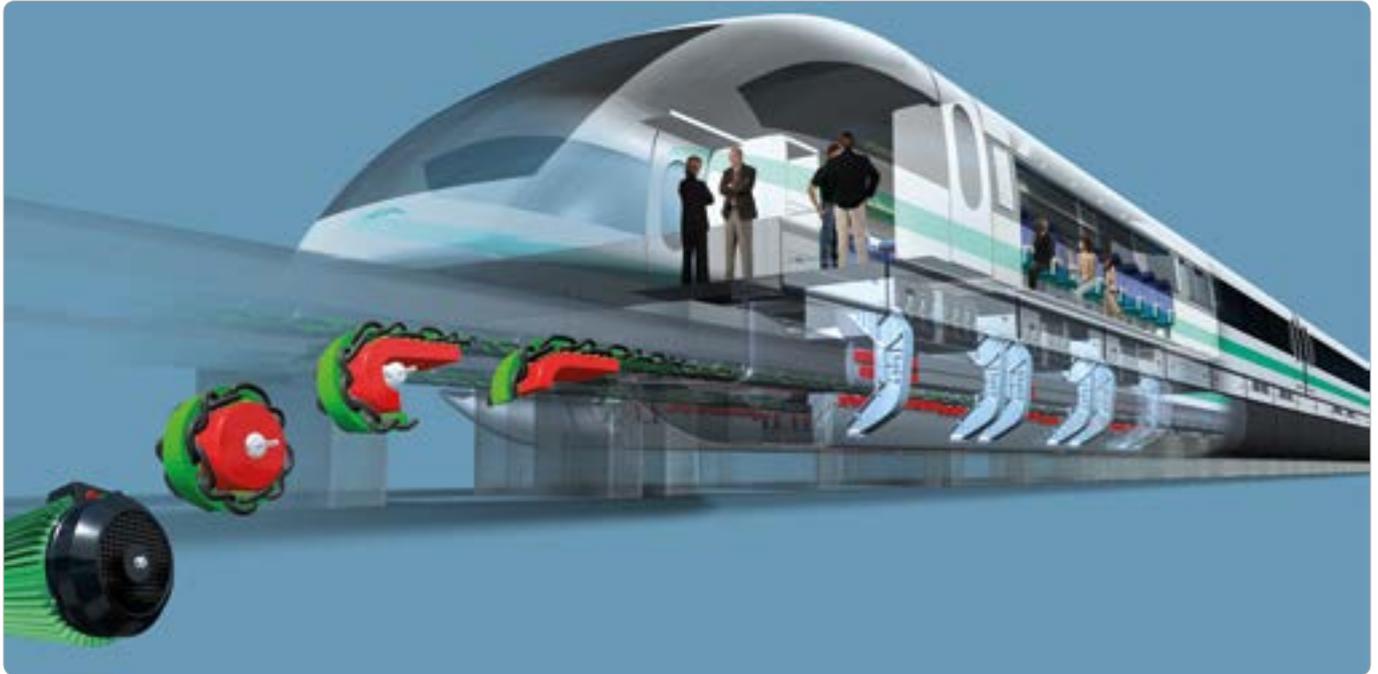
Maglev train rail systems need three components: a large electrical power source, metal coils lining a guideway or track and large guidance magnets attached to the underside of the train.

Two different concepts of magnetic levitation – or suspension – are currently being implemented.

EMS (electromagnetic suspension) uses electromagnets attached to the train’s undercarriage; the magnets wrap around the steel guideway. The system levitates the train about 1 cm above the guideway and keeps it levitated even when it’s not moving. This system is used in Germany’s Transrapid train and the Shanghai Transrapid maglev train



Japan’s MLX01-1 train holds the world record for fastest maglev train (581 kph)



Cutaway of Transrapid maglev train propulsion system (Illustration: ThyssenKrupp Transrapid GmbH)

that connects Shanghai airport with its metro network.

EDS (electrodynamic suspension) is based on the repelling forces of magnets to levitate the train. In EDS systems, trains float about 10 cm above the guideway. EDS is used in Japan's MLX01 maglev train, the fastest train in the world, which reached a speed of 581 kph in 2003.

In August 2013 the mayor of Tel Aviv, Israel, announced plans to introduce skyTran, an urban maglev transportation system that uses two-seater pods hanging from magnetic rails

IEC work on superconductivity

IEC standardization work on superconductivity doesn't extend to transportation, although IEC TC 90:

Superconductivity, acknowledges that this domain could benefit from applications of superconductivity, in particular where HTS (high temperature superconductors) are introduced. Whilst LTS (low temperature superconductors) materials need to be cooled to about 4 K (-269°C) to demonstrate superconductive properties, HTS materials reach these properties at temperatures as "high" as 77 Kelvin (-143°C) or so.

TC 90 works on preparing International Standards to help the development of commercial markets for new products and/or applications using superconductivity.

As of March 2014 it had published 19 International Standards that concern various kinds of measurements for electronic or mechanical characteristics and properties for composite superconductors, including HTS.

TC 90 sees HTS as very promising for new applications and markets. Even so, their widespread use in maglev technology is still some years away – but then so too is the commercial operation of maglev trains.



skyTran urban mass transit pods use maglev technology (Image courtesy of skyTran)

Can smart traffic and cars save lives?

Road safety has been steadily improving; the trend is expected to continue

Morand Fachot

Each year, an estimated 1,3 million people die in road traffic accidents; a further 20-50 million are injured. Technologies that include new safety devices, connected and autonomous vehicles and intelligent transportation systems with their associated infrastructure and systems are expected to improve this poor record. Car manufacturers, governments and other organizations are all working to achieve this goal and are heavily reliant on International Standards.



Driver and passenger airbags helped cut road accident deaths

Huge human and economic cost

According to the WHO (World Health Organization) around 1,3 million people die in road traffic accidents every year, with pedestrians, cyclists and motorcyclists accounting for half of the total. Most of these deaths occur in low- and middle-income countries.

The WHO estimates that road traffic fatalities will be the fifth leading cause of death by 2030.

However, statistics can be misleading as the large numbers of victims reflect an exceptional growth in global road traffic in recent years. In most developed countries, the number of road accident fatalities has been steadily diminishing for decades. In the US, for instance, fatalities in car accidents dropped by 30% between 1994 and 2011 (in spite of a 20% increase in the number of drivers and 33% growth in the number of vehicles).

Overall in 25 European Union countries (i.e. not including the 3 to join most recently) road traffic deaths (including motorcyclists and non-motorists) fell by 54% between 1992 and 2009.

From passive...

The falling rate of road traffic accidents observed in many countries is by and large the result of the gradual adoption of passive and active safety measures and devices. Changes in road traffic regulations and improved road and signalling infrastructure have also played their part.

Seat belts and airbags are the best examples of passive safety devices. Compulsory wearing of seat belts for drivers, front and rear passengers, which started being introduced in most countries from the 1970s, has made a great contribution to cutting the number of deaths and serious injuries caused by road accidents. Airbags, now standard equipment on most cars, offer additional safety by protecting occupants from hitting parts of the vehicle's interior in case of a hard impact.

...to active safety

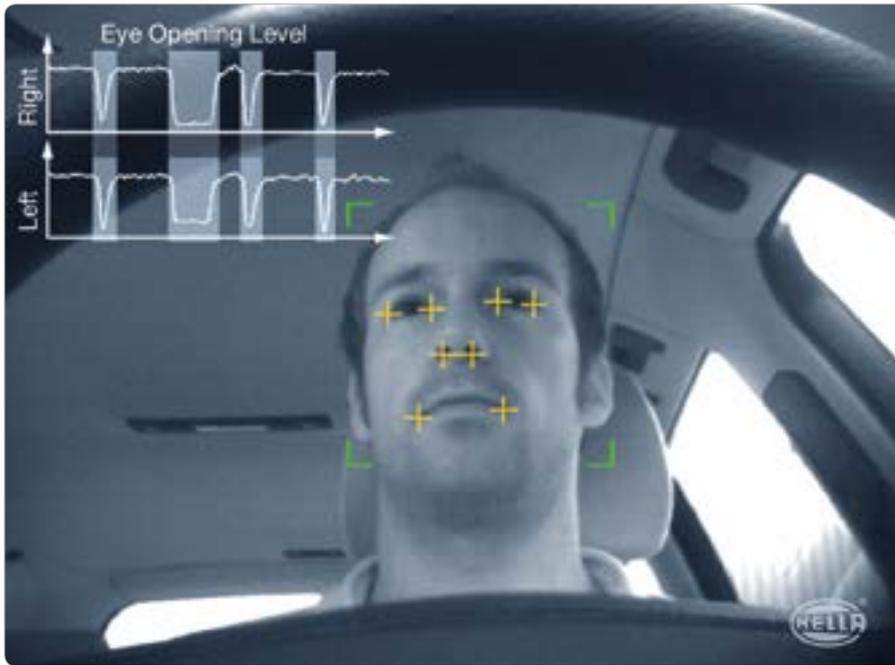
Active safety is provided by devices that help prevent crashes, or reduce

their seriousness. They are triggered and operated by electronic systems introduced more recently than passive devices.

ABS (anti-lock braking system), which has been fitted gradually to cars since the mid-1980s, is an active safety system that prevents the wheels of a vehicle from locking up, reduces braking distance and helps avoiding uncontrolled skidding in case of emergency braking, allowing the driver to remain in control.

ESC (electronic stability control), first rolled out in the early / mid-2000s, helps avoid crashes by detecting the likelihood of vehicles losing traction and going into a skid during sudden manoeuvres such as avoiding an obstacle in front. ESC applies brakes to wheels independently, so reducing the risk of such skids occurring.

Lane departure warning systems, using cameras and sensors, warn drivers when their vehicle moves out of its lane; they help prevent accidents provoked



This camera-based alertness assistant detects the blink of the eyelid and calculates the blink frequency and blink duration (Photo: Hella KGaA)

by drowsiness or distraction. Blind spot monitoring alerts drivers to possible risks that may be in blind spots to the side of the vehicle and so could go undetected. Other recent advanced active safety systems include adaptive cruise control, which automatically depresses and releases the accelerator pedal to stay even with traffic even as speeds of other vehicles vary, and anti-collision equipment that apply brakes when the driver is distracted.

All passive and active safety devices and systems, including many driver assistance systems that offer additional safety features, were initially offered either as standard features on the priciest luxury models or as optional and costly extras on other cars before becoming standard equipment on all vehicles.

These devices rely entirely on countless electrical and electronic components such as sensors or MEMS (microelectromechanical systems), and all their associated components, such as connectors, cables, fuses or drives, or improved lights, which are covered by IEC International Standards (see article in

this *e-tech* on electric/electronic content in cars) and for some by IECQ, the IEC worldwide approval and certification system embracing the supply of electronic components and associated materials and assemblies and processes.

Smart transportation looming on the horizon

If passive and active safety devices have contributed greatly to cutting the numbers of road accident victims in many countries, new technologies made possible by ICT (information and communications technology) herald additional benefits for road safety. The average car has 50 computers, some have as many as 100 and the trend is growing, Jeffrey J. Owens, Chief Technology Officer and Executive VP, Delphi Automotive, told participants in a symposium on the Future Networked Car, held on the fringe of the 2014 Geneva Motor Show.

A car is no longer a machine that gets occupants from A to B, but increasingly a software-driven platform that keeps them plugged in, informed, entertained and safe.

Today's new drivers live in a connected world and expect a connected car. They want to bring their connectivity and the environment they have in the office and at home into the car. The challenge is to do that safely and with less distraction, as there are enough opportunities for distraction in road traffic as it is, Owens said. The aim is to have more connectivity and less distraction.

Towards the self-driving car

As is often the case when humans meet technology, people are often the weakest link. Connectivity aims to help drivers when they need it by providing technology which ensures that, even if the driver is distracted, the car never is.

One objective is to create a "safety envelope" around the car. Technologies for this, such as predictive forward collision system (for the car in front plus one) or steer-by-wire, already exist and hint at forthcoming autonomous driving capabilities.

One long-term objective is to provide the possibility of autonomous driving when drivers want / need it. Certain modes of automated transport are already in operation (see article in this *e-tech* on pods at Heathrow Airport and Masdar City). Autonomously-driven cars have already been tested on highways, so far without causing any accidents.

Government regulators are already encouraging further automation and communication between vehicles. In early February 2014 the US Department of Transport announced a plan to require auto makers to equip new cars and trucks with so called V2V (vehicle-to-vehicle) crash-avoidance systems that allow vehicles to communicate with each other to avoid crashes. The DoT estimates that V2V communication could prevent up to 80% of accidents that don't involve drink driving or mechanical failure.

Liability and security issues

Connected and networked cars may pose a number of legal issues. One that has been encountered before is that of liability.

Car manufacturers have recalled and are still occasionally recalling cars when a fault appears, often after several years. When these faults have resulted in fatalities, manufacturers have even faced costly lawsuits.

In the case of networked cars the liability issue becomes more complicated: it may prove difficult to establish if accidents are due to mechanical or electrical faults, software or communication problems or to other issues, such as hacking.

Another issue that has been mentioned is that breaches of security in cars'

ICT systems might result in vehicle malfunction and accidents occurring. Manufacturers are aware of these risks and are working to reduce and suppress the likelihood of their occurrence.

Safer driving conditions for all in the future

Connected and networked vehicles will undoubtedly have a positive impact on road safety. Experts forecast they could result in a further drop of 50% or more in the number of road traffic victims.

However, it must be borne in mind that the number of victims is unequally shared between countries and regions. Low- and middle-income countries currently account for 48% of the world's vehicles but more than 90% of



Advances in car electronics and connectivity are heralding the introduction of self-driving vehicles

the world's road traffic fatalities.

As the cost of electronics in cars is forecast to reach 65% of their overall value in a few years, it is clear that the benefits of connected cars are likely to be felt initially mainly in high-income countries before reaching other nations further into the future.

Easier, safer, leaner and cleaner

Greater electrical and electronic content in cars lightens drivers' burden

Morand Fachot

Most major automobile manufacturers now offer a variety of EVs (electric vehicles). However, this offering often obscures the fact that the electrical and electronic content in vehicles powered by internal combustion engines has been growing steadily over the years. This makes for safer, more fuel-efficient and comfortable driving, and drives the growth of a global industry.

Internal combustion engines rely on... electricity

Petrolheads are often dismissive of EVs, focusing instead on the performance and features of their cars. However, they often forget (or ignore



Well-designed EEA (electrical electronic architecture) plays a vital role in modern cars (Photo: Delphi Automotive PLC)

the fact?) that even conventional cars rely increasingly on a multitude of electrical and electronic systems to operate successfully.

For decades electrical installation and components in cars were confined to essential functions and basic safety features.

Electric starter engines that could provide enough power to crank and start the engine were introduced widely from the 1920s and were the first significant electrically-based system in cars. They replaced hand cranks (or starting handles) and proved a major advance for internal combustion engines. They relied on a lead-acid battery to provide sufficiently high voltage and current.

The other electrical systems to be installed in cars early on were headlamps and tail lights, supplanting acetylene and oil lamps. Additional lamps such as indicators were introduced later. Other electrical components – for instance, alternators supplying electricity to electrical loads and batteries, ignition coils, motors for windshield wipers, etc. – were introduced step by step and made up most of a car's electrical content for several decades.

More comfortable driving

To lure customers away from the competition, manufacturers have gradually introduced a variety of features to make driving easier and more comfortable; often these have relied on electrical components. Initially they were available on top of the range vehicles only or at extra cost; now many of these features, such as electric windows, heated rear windscreens and air conditioning, are standard equipment in most cars.

Other systems like power steering or automatic transmission, which help to make driving easier and more comfortable, were primarily hydraulic



The introduction of hybrid and other EVs has boosted the electrical/electronic content in cars (Photo: Volkswagen AG)

systems initially. Gradually they have incorporated electrical and electronic components that make them easier and more reliable to operate.

Today, many other car systems besides power windows, electric power steering and electro-mechanical transmission rely on electrical or electronic components. They include light and rain sensors that automatically switch on lamps and wipers, cruise control allowing drivers to maintain a constant speed and advanced parking support systems that manoeuvre cars automatically into a selected parking space. All these contribute, along with a variety of other aids, to better driveability, increased comfort and reduced driver distraction.

Safety first

Improving road safety has been another major factor in the growing electrical and electronic content of motor vehicles. Sensors play a crucial role – for example by setting off airbags if accidents occur and by detecting critical situations so as to prevent a skid using ESC (electronic stabilisation control) or ABS (anti-lock braking system). Safety is likely to improve further with the introduction of many other devices such as pre-crash systems that control the brakes, automatic steering so as to mitigate the seriousness of accidents and collision-avoidance systems that detect hazards or alert careless

or drowsy drivers by issuing sound, vibration or light warnings.

Systems that use information transmitted from roadside infrastructure systems and rely on electronics to control engines and brakes are also being developed.

Safety is further enhanced by better lighting emanating from LED lamps that are more luminous than conventional lamps.

Leaner and cleaner

A number of electronic systems now ensure cars powered by internal combustion engines are more fuel efficient and cleaner than ever whilst offering better performance. Fuel injection, particularly of the electronic variety, has greatly improved the running of engines. It allows smoother driving, better operation throughout a wide range of temperatures and is more efficient, as less fuel is needed for the same power output. As a result exhaust emissions are cleaner, containing combustion by-products that are less toxic and relatively easy to eliminate using clean-up devices such as catalytic converters.

Other technologies help save fuel and cut emissions. They include Start/Stop in which double-layer capacitors shut down and restart engines automatically when vehicles wait at traffic lights or stop frequently, or braking recuperation

that recycles the energy normally lost during braking by storing it and then using it for acceleration or re-starting.

Growing share in the value of automobiles

Electrical and electronic systems are wholly responsible for the advances made in many areas of the automotive industry. This is particularly true for electronics, which have made a spectacular contribution to the increase in overall value of cars in recent years. In the mid-2000s, electronics accounted for 10-15% of the total production cost of mid-range cars and 20-30% of the cost of luxury models.

Today they represent some 20-30% of the total cost for all categories of cars, and this share is expected to reach 40% or so by 2015. The figure is nearer 50% if all electrical systems are included. This growth is set to continue: a recent study by A.T. Kearney, a consulting firm, predicts that a car's embedded software and electronics will account for up to 65% of its total value by 2025.

IEC Standards apply across all domains

Road vehicle standardization relies on a number of international, regional and national regulations and directives.

The main requirement is that cars should comply with the UNECE (UN Economic Commission for Europe) rules as defined by its World Forum for Harmonization of Vehicle Regulations (WP 29). Most countries — with the notable exception of the US and Canada, which have their own directives — recognize the UNECE Regulations and apply them in their own national requirements. They must also comply, when relevant, with national and regional rules and regulations. Many of those apply to equipment that depends on electrical and electronic systems.

In March 2011, IEC and ISO (International Organization for Standardization) signed an agreement concerning the standardization of electrotechnology for road vehicles and cooperation between ISO TC 22: Road vehicles, and IEC TCs (Technical Committees).

All road vehicles, even those powered by internal combustion engines, rely increasingly on such systems. More than 3 dozen IEC TCs and SCs (Subcommittees) cover the standardization of equipment used in and related to road vehicles as well as of other associated issues.

They include: IEC SC 17B and SC 17D: Low voltage switchgear and controlgear, and their assemblies; TC 20: Electric cables; TC 21: Secondary cells and batteries; SC 22G: Adjustable speed electric drive systems incorporating semiconductor power converters; SC 23E: Circuit breakers and similar equipment for household use; SC 23G: Appliance couplers; SC 23H: Plugs, Socket-outlets and Couplers for industrial and similar applications, and for Electric Vehicles; SC 32B: Low voltage fuses; SC 32C: miniature fuses, TC 34: Lamps and related equipment; SC 37A: Low-voltage surge protecting devices (surge protection of electronic devices will be a very important consideration for plug-in EVs) and SC 47A: Integrated circuits. Naturally IEC TC 69: Electric road vehicles and electric industrial trucks, plays a crucial role in the development of future automotive products and its importance and workload are set to grow in coming years.

IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components, has a scheme covering certain International Standards developed for the EV industry. These Standards cover plugs, socket-outlets, vehicle connectors and vehicle inlets for conductive charging of EVs, conductive charging systems for EVs and secondary lithium-ion cells.

Manufacturers producing electrotechnology components and systems for the automotive industry also rely on IECQ, the IEC Quality Assessment System for Electronic Components, covering the supply of electronic components and associated materials and assemblies, to ensure that their products meet the requirements of the car industry.

Global industry

As the electrical and electronic content of cars has increased, so has the overall value of the industry, opening up many opportunities for manufacturers. The current size of the global car market gives a good indication of the size and growth potential of the electrotechnology content of cars and of its overall value. Over 63 million motor cars were produced in 2012, in addition to 21 million commercial vehicles, according to the OICA (International Organization of Motor Vehicle Manufacturers).

Together, the world's top 10 car producers had revenues of nearly USD 1 375 billion in 2013, according to Forbes. As electronic components alone account for a very substantial share of the total costs for all categories of cars, they constitute a highly significant global market, and one that is set to grow further. This expansion would not be possible without the standardization work done by many IEC TCs and SCs.



This car overhead control centre integrates complex electronics for multiple functions into a limited space (Photo: Hella KGaA)

EV wireless charging system: a standardization challenge

*Dimitrios Ladas**

Since 2011 Dimitrios Ladas, IEC 2013 Young Professional Leader, has been a member of the IEC TC 69: Electric road vehicles and electric industrial trucks, project team which develops the Standard for Wireless Power Transfer for EV charging. In this article he gives insights into the standardization challenges that developers of the EV (Electric Vehicle) wireless charging system face...

EV market context

For several years, the automotive industry has invested a lot in the development of electric vehicles. Some manufacturers have chosen to focus on full electric cars whereas others have decided to work on hybrid and plug-in hybrid models. For instance, the French car manufacturer Renault has invested EUR 4 billion in research and development to develop a range of full electric cars.

This represents a major business opportunity for the electrotechnology industry because all these new cars will need to charge their batteries. Basically, we can imagine that the scheme is very simple: you can put an electric charging cable between the socket and the car and it should work. Unfortunately, we are here at the interface of two different worlds – automotive and electrical distribution

The chicken or the egg?

With EV charging systems a complicating factor is that there are diverging views on the process and timing. Some believe that we first need to have the cars before providing a widespread charging infrastructure



Dimitrios Ladas, IEC 2013 Young Professional Leader,...

i.e. a network of charging points that ensures car drivers that they will always find a charging solution on the road. Others believe the electric vehicle market cannot grow quickly unless a real charging infrastructure is already

in place.

In this article I will share some insights about a specific charging system: the Wireless Charging system, which could be an enabler of EV market growth. From cable to wireless charging systems

The current EV charging systems are all based on a cable that connects the EV to the grid. The charger can be embedded in the car or positioned externally, but the cable is mandatory. For the user, this represents a constraint, because the cable can be dirty or difficult to handle.

To provide a more convenient charging system ICPT (Inductive Coupling Power Transfer) technology can be used to transfer energy to charge a vehicle without any cable to handle. In a nutshell, this technology consists of a charger which is split in two parts. There is an emitter (on the ground) which is connected to the



...is a member the IEC TC 69 Project Teams PT 61980-2 and PT 61980-3...



...which develop the International Standards for Wireless Power Transfer for EV charging (Image: Arriva)

grid through a converter. This device generates a magnetic field, which is used by a receiver (underneath the car) that transforms the magnetic field into current that is used to charge the battery. With such a system, the driver can just park and charge, without having to think about plugging in the cable.

Complex standardization landscape

In TC 69, the IEC Technical Committee that is responsible for EV charging system-related standards, a project team has been set up to address the ICPT charging systems. Ideally, the

objective is to agree on one International Standard so that manufacturers have a reference system. But there are several points that augment the difficulty with regard to cable-based systems. First of all, the market for wireless charging is not yet developed. There are trials and many manufacturers have demonstration models, some even have products, but the Standard is still in advance of the market.

The technical aspect of the system is very difficult and not so obvious to standardize. As it involves a magnetic field, the project team has to take care about public fear of electromagnetic waves. This context is not unusual in

standardization, but the combination of difficult technical questions and the framework of electric vehicle leads to a complex situation where consensus is difficult.

IEC Young Professionals - 2014 workshop, Tokyo

The IEC Young Professionals - 2014 workshop will be held in Tokyo, Japan, from 10 to 12 November, in parallel with the IEC 2014 General Meeting. Please contact your NC for further information.

** Since 2010 Dimitrios Ladas has been the project leader of the EV (Electric Vehicle) Inductive Charging project at Schneider Electric, Grenoble, France.*

Heavy lifting

EVs muscle in on heavy industrial applications

Morand Fachot

Mention of EVs (electric vehicles) immediately brings to mind electric cars and possibly urban transport vehicles such as trolleybuses or electric buses. However, it is also important to consider commercial and industrial EVs as they represent 60% of the value of the overall EV market. IEC Standards are essential for the further development and introduction of this class of EVs and for the entire EV sector.

An eclectic electric vehicle market

Certain types of EVs are already widely present in the industrial and commercial sectors.

Materials handling vehicles, such as pallet trucks, reach trucks, counterbalance stand ups and counterbalance forklifts are obvious examples of vehicles that are often powered by electricity. This may be imposed through laws and regulations; for instance in certain countries, forklifts have to be electric when used inside buildings so as to prevent emission of noxious fumes.

Electric forklifts first appeared in the 1940s, but were only deployed on a commercial basis after World War 2. They can be powered by lead-acid batteries, but these may not last a full working day and may take up to 8 hours to recharge.

More recently materials handling vehicles powered by FCs (fuel cells) have been introduced. In contrast with lead-acid systems FCs can be recharged in a matter of minutes. Their weight is not a drawback as, in common with lead-acid batteries,



FC systems can easily be retrofitted to replace lead-acid batteries into forklifts, like in this machine (Photo: Yale)

they act as counterweights in forklifts. FC-powered vehicles can also be used in cold environments, such as cold stores, as their performance is not degraded by low temperatures.

In future, the FC and battery combination is expected to be used for a hybrid mix of FCs and electric storage for batteries and super capacitors. Already under development is a FC and battery hybrid that helps recover energy as forklifts raise and lower loads.

Energy is supplied as the forklift raises its load and is then recovered as the lift comes back down. The recovered electric power can be used in a generator to charge the battery and keep the cycle going.

Shifting and lifting beyond forklifts

Short range is often perceived as a drawback for personal EVs, but this

may not be relevant in the case of commercial and industrial EVs. These are often used in limited environments and so may not need to cover vast distances between charges. This is certainly the case for airports' GSE (Ground Support Equipment) such as aircraft tugs, baggage tractors, belt loaders, shuttle buses and cargo moving equipment.

There are about 300 000 GSE vehicles in the world's airports today, including in the commercial airports used for freight and by the oil industry and in military airports. In a report on industrial and commercial EVs, market research company IDTechEx estimated the sale of EVs for airport applications to be between 30 000 and 39 000 units in 2013.

Airports are often funded or controlled by governments or local/regional authorities and are under pressure to convert their GSE to electric versions.



Four-wheel drive / four-wheel steer SCHOPF F110 electric tractor designed to move aircraft up to 150 tonnes (Photo: SCHOPF)

Comparable machines in other markets are electric yard or heavy duty tractors for use in harbours or warehouses to pull containers or trailers.

Some commercial and industrial EVs are also available as hybrid or plug-in hybrid vehicles or are equipped with range extenders powered by fossil fuels (petrol or liquid gas).

Another emerging trend likely to boost the adoption of industrial EVs is the rollout of driverless or fully automated systems. These are already in use in warehouses and in the mining industry.

Fast-growing sector for slow-moving vehicles

Unlike in the personal EV industry, where manufacturers are launching many models, sometimes without prospects of significant ROI (return on investment) so as to keep up with their competitors, the commercial and industrial sector demand for EVs is driven by other considerations. These include the quest to lower the operating costs of large fleets and the need to meet ever more stringent government emissions limits.

These will drive the introduction of EVs into previously uncharted territory, that of earthmoving, mining, agricultural and outdoor machinery.

Major earth-moving equipment manufacturers such as Caterpillar, John Deere and Komatsu, have already introduced hybrid electric earth-moving machines that can cut fuel consumption by 25% or more.

IDTechEx expects the commercial and industrial EV sector to more than quadruple between 2013 and 2023. It forecasts that 706 000 purely electric forklifts will be sold in 2020, almost all for indoor use, together with 750 000 other heavy industrial vehicles, mainly hybrid forklifts used outdoors and self-propelled cranes. Agricultural, mining and earthmoving electric vehicles will also be included in this latter category.

To this should be added 110 000 electric buses and 377 000 light industrial and commercial EVs.

IEC standardization supporting the expansion

Many IEC TCs (Technical Committees) and SCs (Subcommittees) are working on Standards for systems and components used in the EV sector. The following list is not exhaustive.

IEC TC 69: Electric road vehicles and electric industrial trucks, is obviously a major player. It prepares Standards for motors and motor controllers, on-board electrical energy storage systems and for power supplies and chargers.

TC 21: Secondary cells and batteries, prepares Standards for secondary batteries for the propulsion of electric road vehicles. These batteries can be of the lead-acid, lithium-ion, nickel-metal-hydride or lithium iron phosphate types, for instance.

Fuel cells are increasingly being used in commercial, industrial and personal EVs. TC 105 prepares International Standards for FC technologies. In January 2013 three global car manufacturers announced they were pooling resources to bring FCEVs to the market as early as 2017. FCs are already widely deployed in the industrial and commercial EV sector.

Capacitors and supercapacitors are being used more and more widely in vehicle applications, with supercapacitors sometimes replacing traction batteries, Standards for capacitors are prepared by TC 33: Power capacitors and their applications.

TC 69 liaises and collaborates with TC 21 and TC 105, as well as with other IEC TCs and SCs involved in electromobility. These include SC 17D: Low-voltage switchgear and controlgear assemblies, SC 23E: Circuit-breakers and similar equipment for household use, SC 23H: Plugs, socket-outlets and couplers for industrial and similar applications, and for electric vehicles, and TC 64: Electrical installations and protection against electric shock.

IEC standardization work for EVs supports an industry which is set to reach a global gross value market of USD 334 billion by 2023.



This Caterpillar 336E H hybrid excavator uses up to 33% less fuel than its 336D diesel equivalent (Photo: Caterpillar)

Behind the scenes at the Sochi Olympics

IEC International Standards helped to make things work

Janice Blondeau

Invisible but essential for the success of the Sochi 2014 Winter Olympics, IEC work underpinned a host of technologies which helped in the smooth running of the Games.

Invisible but essential

From access control and transportation for visitors, to timers and information systems for officials and athletes, cameras, microphones, lighting for announcers and the media, the stoves and appliances for catering, as well as the kilometres of cables and fibre optics in electrical and communication installations, IEC TCs (Technical Committees) and SCs (Subcommittees)

prepare International Standards for a myriad of components and systems that were used throughout the Games venues and in the Sochi region.

Rail away to Sochi

The Sochi Aeroexpress, a special train link was constructed from Sochi International Airport to the city of Sochi to make transport easier. IEC TC 9: Electrical equipment and systems for railways, prepared the International Standard IEC 61373, *Railway applications - Rolling stock equipment - Shock and vibration tests*, which sets down testing requirements for railway vehicle equipment subjected to vibrations and other similar shocks in connection with railway operations.

Timing is everything

Measuring athletes' performances relies on sensors, and optoelectronic sensors in particular, used to trigger chronographs to measure time as competitors go past them.

TC 47: Semiconductor devices, and its subcommittees prepare International Standards for the design, manufacture, use and reuse of discrete semiconductor devices, integrated circuits, display devices, sensors, electronic component assemblies, interface requirements, and micro-electromechanical devices.

Electronic display devices form an integral part of all sporting events to show times, scores, and even



IEC International Standards helped to ensure many aspects of the 2014 Winter Olympics in Sochi. (Photo: romantiche/123RF Stock Photo)



Work that was invisible but vital to enable timers, cables, lighting, cameras... (Photo: Russian govt.)

replay some of the action. TC 110: Electronic display devices, works on standardization in the field of electronic display devices and their specific relevant components. TC 34: Lamps and related equipment, prepares standards for lamps and LEDs (Light-Emitting Diodes) used extensively in lighting throughout the Sochi Olympics.

Cables bring us the Olympic feats

To show audiences around the world athletes' performances, photo agency Getty Images in a joint effort with AP (Associated Press), AFP (Agence France-Presse), Reuters and epa (european pressphoto agency) used a 20-kilometre fibre optic cable supporting a 100Mbps network that delivered images from southern Russia to the rest of the world within three minutes.

TC 86: Fibres optics, prepares standards for fibre optic systems, modules, devices and components intended for use with communications equipment, including indoor and

outdoor cables, to ensure reliable system performance and operation.

One US television chain reportedly invested in 120 kilometres of cable for its television coverage of the Sochi Games. TC 100/TA 5: Cable networks for television signals, sound signals and interactive services, develops International Standards relating to cable networks including processing and distribution of television and sound signals. TC 100: Audio, video and multimedia systems and equipment, prepares international publications in the field of audio, video and multimedia systems and equipment including specification of the performance and interoperability with other systems or equipment.

Ventilation and cooling

A number of IEC TCs and SCs are involved in the preparation of International Standards for components and systems used in the ventilation and cooling of installations and devices – all key technologies when it came to

keeping ice frozen for skaters and air flowing in areas with lots of people.

In the indoor arenas in Sochi where ice hockey and ice skating took place, underfloor cooling systems ensured that the ice didn't melt. This process used a chemical called propylene glycol, cooled in a refrigeration system and then pumped through to chill pipes in aluminium panels that sat directly below the ice. SC 61C: Safety of refrigeration appliances for household and commercial use, prepares International Safety Standards for motor compressors, refrigerating appliances and similar appliances for household and commercial use.

IT standardization work central to Olympic Games organization

Ensuring the security of major global sporting events such as the Olympic Games represents a major challenge for organizers. The contests attract huge crowds and universal media coverage. Underpinning the overall security system



...microphones, heating, cooling, transport, communications systems and much more.

for the Sochi Olympics were electronic devices and installations that rely on International Standards prepared by ISO/IEC JTC 1, the IEC and ISO (International Organization for Standardization) Joint Technical Committee that deals with Information Technology matters. ISO/IEC JTC 1 work was also widely used in systems that allowed spectators back home to enjoy the Olympic experience in front of their televisions.

Biometrics, automatic identification and security

Technological solutions to secure the site areas including ACS (access control systems) comprising RFID (radio-frequency identification) token and biometrics are covered by the work of ISO/IEC JTC 1/SC 31: Automatic identification and data capture techniques, and ISO/IEC JTC 1/SC 37: Biometrics.

Security surveillance for the Sochi Games included drones, reconnaissance robots, extensive network monitoring, sonar systems and high-speed patrol boats. Drones and robots are essentially electromechanical systems that include electrical and electronic parts that depend on International Standards to operate properly and safely. These are prepared by various IEC TCs and SCs such as TC 47: Semiconductor devices, TC 44: Safety

of machinery Electrotechnical aspects, or SC 65 A: Industrial process measurement, control and automation.

Is it a bird? No it's a drone (camera)

These Olympics also provided a showcase for the use of drones in broadcasting live video of snowboard and ski jump competitions. Olympic Broadcasting Services, which provided the official world feed of all the events at the Games used a drone in Sochi. Broadcasting live from a remote-controlled device required an extra transmitter to send back live video and allows closer angles than from a helicopter. IEC TC work is once again not far away. TC 2: Rotating machinery, prepares International Standards regarding specifications for rotating electrical machines and TC 91: Electronics assembly technology, prepares International Standards on electronic assembly technologies including components.

Power up for Sochi Games

The successful hosting of sporting events, as well as preparing and transmitting media coverage of the Olympics depended on consistent, reliable sources of electricity, as did the various Olympic events that took place after nightfall or in enclosed athletic facilities. In addition, the remoteness of Sochi meant it needed new roads,

increased train capacity, and new rail lines, all of which required power.

When Sochi was selected to host the winter Olympics it was far from major pipelines and energy transmission. Since 2007, Russia has built 49 major energy projects, according to its Energy Ministry. This has increased the capacity to generate electricity in the Sochi region by 800%.

A new power plant with two 90 MW generators, and running on two steam turbine units, was predicted to supply more than 25% of the energy needed during the 2014 Olympic Games. Expected to generate about 1,5 million megawatt hours of electricity per year, the Dzhubginskaya plant aimed to keep the Olympics on the grid and in the future it will also provide power to 5 million people who live in the southern Krasnodar Krai region. This plant has major importance for modernizing the region's energy sector according to local authorities.

Turbines, transformers and energy measurement and control

TC 5: Steam turbines, prepares specifications and International Standards for the rating and testing of steam turbines. TC 14: Power transformers, conducts standardization in the field of power transformers, tap-changers and reactors for use in power generation, transmission and distribution. TC 13: Electrical energy measurement and control, prepares International Standards in the field of a.c. and d.c. electrical energy measurement and control, for smart metering equipment and systems forming part of smart grids, used in power stations, along the network, and at energy users and producers.

So next time you sit down to watch a gripping global sporting event such as the Olympic Games or the World Cup, spare a thought for the thousands of technical experts whose work has helped to make the event run smoothly.

Personal systems herald “smart mobility”

New systems will introduce personalized modes of transport in urban areas

Peter Feuilherade

Automated or “self-driving” personal transport systems are no longer the preserve of science fiction. They are now up and running at several locations around the world. IEC standardization work will prove instrumental in the expansion of systems that use innovative pod-type vehicles as well as for two- and three-wheeled “personal transporters”.

Personal, rapid, clean and safe

Small self-driving electric powered vehicles running on dedicated guideways and designed for on-demand use by individuals or small groups, typically four to six passengers, are often referred to as PRTs (personal rapid transit systems).

PRTs are intended to combine the convenience and privacy of cars with the environmental benefits of mass transit. Their primary aims are to achieve optimum door to door mobility, improve safety, reduce environmental impact and lower operational costs.

They are part of the advance towards a new era of “smart mobility” in which infrastructure, methods of short distance transport, passengers and goods will be increasingly interconnected, especially in urban areas.

PRTs operate on networks of specially built guideways, with traffic controlled by a central computer to eliminate collisions and minimize congestion.

They are usually powered by onboard batteries recharged at stops, and guided

by GPS (Global Positioning System) to destinations selected on touchscreens. Conventional steering can be used on a simple track consisting only of a road surface with some form of reference for the vehicle’s steering sensors.

The oldest system similar to a PRT has been in operation since 1975 in the US city of Morgantown, West Virginia. Comprising cars which hold about 20 passengers and run on a ground-mounted rail, it is more properly described as “Group Rapid Transit”.

Pod systems in operation

Worldwide there are currently two fully operational PRT systems: at Heathrow Airport near London and Masdar City near Abu Dhabi, UAE (United Arab Emirates).



Driverless pod in service at Heathrow Airport (Photo: Ultra Global)

The driverless pod service at Heathrow, operated by UK company Ultra Global, was launched in May 2011. The system comprises 21 pods running at a maximum speed of 40 kph along guideways on a 3,9 km route between Terminal 5 and a business car park; up to 100-120 vehicles can be dispatched every hour.

The pods are powered by electric motors and use Lithium ion (Li-ion) batteries which recharge when parked at stations, bypassing the need for electrification along the track. The batteries provide an average 2 kW of motive power, and add only 8% to the gross weight of the vehicle.

The pods have onboard computers and are guided by laser sensors. Passenger information is updated on LCD screens in the pods, and a wireless communication system allows for two-way exchange of data and commands between vehicles and central control.

Passenger safety measures include continuous CCTV and black box monitoring of all pods; an independent "Automatic Vehicle Protection" system that protects against pod collision on the guideway; safety interlocks between the brakes, motor and doors; and emergency exits, smoke detectors and fire extinguishers fitted in all pods.

A complete pod system like the one at Heathrow, including guideway, stations, vehicles and control systems costs somewhere between USD 7 million and USD 15 million per km to construct, according to the system's operators. They say the pods have saved over 200 tonnes of CO₂ per annum and reduced the number of bus journeys on the airport's roads by 70 000 a year.

Heathrow Airport Limited's business plan for 2014-2019 includes plans for another PRT system linking Terminals 2 and 3 to their respective business car parks.

Personal transporters

Flexible use for multiple applications

Electric stand-up personal transporters (like Segways and their one or two-wheeled derivatives, or alternative machines such as Roboscooters) are devices that are controlled by the body movements of the driver and are equipped with self balancing mechanisms

They are also available as personal scooters in three-wheeled configurations, which offer greater stability and the option of riding seated on larger models. These vehicles are generally powered by Li-ion batteries, removable on some models to allow longer operational cycles. Some versions may include regenerative braking capability, allowing batteries to recharge during deceleration.

Stability is maintained using a combination of computers, tilt sensors, gyroscopic sensors and motors that rotate the wheels forwards or backwards as required for balance or propulsion.

Personal transporters target the individual consumer market for urban commuting or leisure, as well as corporate users including police forces, security firms, ports and airports, factories, shopping centres, campuses, sports stadiums and amusement parks.

Manufacturers in the US estimate the operating costs of three-wheelers used in police patrol duty to be around USD 0,10 per day.

As part of a GBP 75 million UK government scheme to enable businesses to make and test low carbon technologies, trials of driverless cars will start in Milton Keynes, a so-called "new" town 80 km north of London which was built on a "grid plan" in the 1960s.

The specific technology has not yet been announced but plans are for an initial batch of 20 driver-operated pods able to carry two passengers to enter service in 2015, followed in 2017 by 100 fully autonomous (driverless) pods that will run on pathways alongside but separated from pedestrian areas. The vehicles will be able to travel at up to 19 kph and will be equipped with onboard sensors that will enable them to detect and respond to obstacles.

The driverless electric pods used in Masdar City near Abu Dhabi have carried more than 820 000 passengers since the system, designed by Dutch

company 2getthere, was launched in November 2010.

Masdar City is an initiative by the UAE government to build a new small city based on renewable energy and developed around green technologies, including public transport

The pods run at 25 kph and are powered by lithium phosphate batteries, which are charged using solar energy. They travel on tracks equipped with embedded magnets placed every 5 m which the vehicle uses, along with information about wheel angles and speed, to determine its location. Pods designed to carry freight also operate at the site.

Feasibility tests in other countries

Other countries examining the feasibility of PRT systems include Taiwan and Brazil. In Florianopolis, a provincial Brazilian city in which



Driverless electric pods used in Masdar City (Photo: 2getthere)

large parts of the city are laid out on a coastal island while the remainder of the city is on the mainland, car traffic between the two is served by a single bridge, leading to peak time bottlenecks. The local authorities are mulling over using PRT as a local distribution network within the dense central business district situated on the island, as part of a multimodal transport proposal that would include ferries and monorail.

In Singapore, NTU (Nanyang Technological University) and French company Induct Technology are collaborating on tests of a driverless electric shuttle vehicle powered by lithium polymer batteries and capable of carrying 8 passengers at a maximum speed of 20 kph. The vehicle uses laser mapping and sensors to manoeuvre, runs on a predefined route and recharges at docking stations. It serves as a

testbed for new charging technologies such as wireless induction and new super capacitors for electric vehicles.

Other personal urban mobility prototype vehicles have been demonstrated in recent years but never put into production. They include self-driving pods unveiled by the US multinational General Motors Company in 2010. Powered by electric motors and with a range of 65 km, the two-seater vehicles were crammed with technology including roof mounted GPS, Wi-Fi, vehicle to vehicle communication systems, front-mounted ultrasonic and vision systems and collision avoidance sensors.

IEC makes safety top priority

The top priority in the operation of automated public transport networks is to ensure provision of the highest levels of safety while not restricting the introduction of new technology. Such

networks depend heavily on computer-based management, control and communication systems.

The IEC TCs (Technical Committees) whose activities cover automated public transport systems and personal transport pods include TC 9: Electrical equipment and systems for railways, TC 21: Secondary cells and batteries, and TC 47: Semiconductor devices, and its SCs (Subcommittees).

TC 9: Electrical equipment and systems for railways, is responsible for International Standards relating to the systems, power components and electronic hardware and software used in fully automatic transport systems operating in the wider context of urban rail and metro transport (see article on TC 9 in this *e-tech*). This includes safety aspects such as passenger alarm systems and automatic system surveillance. TC 9 works in liaison with other relevant IEC TCs, for example,



Personal transporters can be used for indoor, sidewalk, cross-terrain and patrol use (Photo: Segway)

coordinating with TC 69: Electric road vehicles and electric industrial trucks, on the development of double-layer capacitors for energy storage, and with TC 56: Dependability, which covers the reliability of electronic components and equipment and is included as a characteristic of quality.

TC 21: Secondary cells and batteries, prepares International Standards for all secondary cells and batteries. This covers the performance, dimensions, safety installation principles and labelling of batteries used in electric vehicles.

TC 47 and its SCs prepare International Standards for semiconductor devices used in sensors and MEMS (micro-electromechanical systems) installed in personal transport systems.

Driverless vehicles approaching

Existing PRT networks, albeit small-scale, combine the advantages of flexibility in terms of planning available with individual means of transport with those of urban public transport systems. They have proved safe, reliable and environmentally friendly and offer a feasible public transport option for tourist attractions, business parks, hospitals and university campuses. They could also be one way forward for “last mile” solutions

in urban environments, although the density of traffic in cities would pose more complex and diverse challenges than, for example, in an airport setting.

Consumers would pay a fraction of the cost of buying and running an individual car, while building dedicated trackways would be much cheaper than the cost of most traditional transport infrastructure.

As the Heathrow system’s operator told *e-tech* in an interview, “an innovative and now proven technology that responds to patrons’ desire for on-demand, direct and personal transport should be seen not only as a viable but altogether a more economically, socially and environmentally beneficial alternative to conventional forms of public transport”.

The wider significance of driverless pod networks is that they are part of a long term trend in the car industry to develop autonomous vehicle control systems equipped with a combination of sensors and dedicated software for the personal mobility sector.

Tests on autonomous cars have already begun. As well as the Milton Keynes trial set for 2015, NTU in Singapore has tested a driverless electric vehicle on a 2 km shuttle route, while autonomous

electric cars have also been tested on roads in Japan. In the US, the technology giant Google has been licensed to experiment with driverless vehicles, and says that in tests its cars have logged about 500 000 km without an accident. And in 2017 the Swedish city of Gothenburg will start a pilot project with 100 cars and 100 regular drivers who will manually drive cars to roads where they then join road trains and switch to autonomous driving.

Software will be crucial to autonomous travel, not only to calculate a vehicle’s position and route from a constant stream of incoming data, but also to react to unforeseen obstacles.

However, it could be decades before passenger cars driving autonomously win consumer and government acceptance to reach the mass market. One way to help promote autonomous driving would be to incorporate technologies such as coordinated traffic lights and smart parking systems in the design of smart cities.

The US based market research and consulting firm Navigant Research forecast in August 2013 that sales of autonomous vehicles would rise from fewer than 8 000 annually in 2020 to 95,4 million in 2035, representing 75% of all light duty vehicle sales by that time. In addition to advanced driver assistance features now available in some vehicles, such as adaptive speed control, automatic emergency braking and lane departure warning, new features that could assume control of more aspects of driving would be introduced gradually, Navigant predicted.

“The first features will most likely be self-parking, traffic jam assistance, and freeway cruising – well-defined situations that lend themselves to control by upgraded versions of today’s onboard systems”, said David Alexander, senior research analyst at Navigant Research.

On the right track

IEC standardization for rail transport contributes to the sector's development



Swiss-made "crocodile" electric locomotive introduced in India in 1928

Morand Fachot

Rail transport is a well-established and pivotal mode of transportation both for passengers and freight and is a key component of the global economy. It has enabled many remote areas to be developed and, far from sliding into obsolescence, it is enjoying major expansion throughout the world. Standardization work by IEC TC 9: Electrical equipment and systems for railways, is central to the growth of the rail sector.

Early urban transport: electricity not steam

Whilst steam power ruled rail transport over long distances in most countries when this mode of transport was first introduced, urban public transport systems were powered by electricity. This started in Berlin in 1879 when the world's first electric suburban railway was inaugurated and electric trams and electric trolleybuses followed soon afterwards.

The first electric-powered underground railway line was inaugurated in London in 1890, with Paris, Berlin and New York opening their own underground electric railway lines in the early 1900s. Underground railway lines gave an impetus to electric traction as steam engines proved obviously impractical in tunnels, from which they were soon banned.

The IEC took the decision to start work on standardization for metropolitan and railway transport networks in April 1924. Minutes of an IEC Committee of Action meeting held in London on 28 April 1924 mention "the decision to refer the question of traction motors to a Subcommittee of the Advisory Committee on Rating, but the Committee of Action felt that it would be wiser to appoint a special Advisory Committee for this subject. It was pointed out that the proposals already circulated appeared to refer only to tramway motors and they felt that the Advisory Committee should review the subject from the point of view both of tramway and railway motors".

This Advisory Committee had the title: Electric traction equipment. It subsequently became IEC TC (Technical Committee) 9: Electrical equipment and systems for railways.

Widespread work with a global reach

Standardization work by TC 9 now extends well beyond "tramway and railway motors". It also includes "rolling stock, fixed installations, management systems (including communication, signalling and processing systems) for railway operation, their interfaces and their ecological environment".

As of March 2014 TC 9 had issued 91 publications covering all the above-mentioned areas, and was working on dozens more.

The TC's membership greatly expanded in line with the scope of its work. The Advisory Committee created in April 1924 was "to consist of one delegate from each of the following [six] countries: France, Great Britain, Holland, Italy, Sweden, Switzerland". Today 395 experts from 26 participating countries are involved in TC 9 standardization work in 5 WGs (Working Groups), 12 PTs (Project Teams), a number of MTs (Maintenance Teams) to revise, maintain and update existing Standards and 5 ad hoc Groups to work on specific issues. Thirteen countries also hold observer status in TC 9.

Changing worldwide environment

TC 9 observes that the sector has experienced significant change. This has greatly influenced the design of railway systems, their operational characteristics and the technologies involved.

It also notes that its work has been affected by regional activities, such as the adoption of EU (European Union) Directives aimed at promoting common standards, open access and competition in the railway sector.

Therefore TC 9 seeks to identify “where there is a need of an attractive action for worldwide standardization by adapting regional standards when possible; creating original International Standards when there is a specific need different from regional ones; focusing its means preferably on general worldwide items”.

The TC sees its goal in the near future as being “responsible for a full coherent set of standards, the ones based on regional standards included”.

In recent years a domain that has seen a significant expansion in TC 9 standardization work is that of communication to interconnect trains, to connect standard on-board equipment and to connect trains to a ground network. To make this possible TC 9 is developing the IEC 61375, *Electronic railway equipment – Train communication network (TCN)*, series of Standards, six of which had been published as of February 2014.

TC 9 has also set up WG 46 to develop Standards for on-board multimedia systems for railways.

Technology and environment

Technology in the railway domain has seen significant performance developments, in particular as regards traction systems, which have benefited from techniques based on on-board power electronics that allow the use of traction motors with their higher power-to-weight ratio.

Network electrification varies greatly from country to country. Worldwide it stands at 26,6%, according to UIC (International Union of Railways) data,



Japan Railways Group Shinkansen high-speed trains

varying from 0% in many countries to 100% (Switzerland). Some countries like India and China have embarked on massive electrification programmes.

Even where network electrification is partial or non-existent, it is worth remembering that even so-called diesel locomotives are actually diesel-electric machines that use a diesel engine to drive an electrical d.c. generator or an a.c. alternator-rectifier to provide power to traction motors.

Relevant for shorter and individual travel too

The expansion of urban and suburban transport and automatic people mover systems is also driving standardization work for TC 9, which set up WG 40: Railway applications – Urban Guided Transport Management and Command/Control Systems, to develop specific Standards.

The gradual introduction of automatic people movers requires specific provisions as these systems are fully automated (see article on automatic people movers in this *e-tech*). TC 9 also focuses its work on environmental issues that include noise emission of equipment, which involves acoustics, as well as EMF (Electromotive force), EMC (Electromagnetic Compatibility)

and stray currents. Environmental issues also include “taking into consideration the disposal, recyclability, reusability and toxicity concerns where necessary”, and energy-efficiency with “projects to assist the reduction of energy consumption in trains and associated infrastructure”.

Safety first

Global railway safety record varies according to countries with obvious differences depending on infrastructure and rolling stock conditions. However, considering the number of passengers and volume of goods transported it is on the whole extremely good, especially when compared, for instance, with road transport.

Train safety is a major concern for manufacturers and operators. As a result TC 9 has identified the following safety aspects as being relevant to its work:

- Electrical safety
- Protection against fire
- Safety hazards in long tunnels
- Passenger safety (including passenger alarm systems and communication between the operator and passengers)
- Event recorders (e.g. so-called “black boxes” or automatic system surveillance)

All these contribute to safer railway transport. In the EU, for instance, there were 2 261 persons killed or seriously injured in railway accidents in 2012. However, the majority (82,1%) of these victims were not passengers travelling on trains or railway employees but “other persons” such as level-crossing users or unauthorized persons on railway premises.

Furthermore, serious accidents which result in significant loss of life, such as the July 2013 Santiago de Compostela derailment in Spain and the Lac-Mégantic derailment in Canada, are more often than not the result of human error rather than of technical failure.

Essential collaboration

Railway transport is a complex sector that relies on many technologies. As such, TC 9 maintains liaison with a number of IEC TCs and SCs (Subcommittees) to determine whether existing Standards developed by these can apply, fully or partly. As a result TC 9 liaises with the following:

- SC 32B: Low-voltage fuses
- TC 36: Insulators
- TC 40: Capacitors and resistors for electronic equipment
- TC 56: Dependability
- TC 69: Electric road vehicles and electric industrial trucks
- TC 79: Alarm and electronic security systems
- TC 99: System engineering and erection of electrical power installations in systems with nominal voltages above 1 kV a.c. and 1,5 kV d.c., particularly concerning safety aspects
- TC 100: Audio, video and multimedia systems and equipment
- TC 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure
- TC 111: Environmental standardization for electrical and electronic products and systems

- CISPR (International Special Committee on Radio Interference) SC B to ensure coordination on EMC aspects
- TC 9 liaises also with IEEE (Institute of Electrical and Electronics Engineers) P1901, which works on the 1901 BPL (Broadband over Power Line networks) Standard, to ensure coordination in the development of communication protocols for train communication networks.

Crucial sector for the global economy

Rail transport is central to domestic and global trade. The public’s attention is often drawn to the latest generation of high-tech, high-speed trains in service or being introduced or planned in many parts of the world. However, if passenger transport, which nearly reached 2 900 000 billion passengers/km in 2012, according to UIC statistics, is the most visible aspect of rail transport for the media and members of the public, freight transport is no less

important. With over 9,8 billion t/km of goods estimated to have been transported globally in that year, it is an absolutely central pillar of domestic and global trade.

The introduction of intermodal freight transport in particular, which made possible the transportation of goods across multiple modes of transportation (lorries, trains, ships), thanks to containerization, has transformed global trade.

Rail transport plays an essential role in intermodal freight transport, in particular over long distances or in countries where the road infrastructure may not support movements of large volumes of freight adequately.

IEC TC 9 standardization work over 90 years has provided and will continue to provide the best possible support to ensure the safe and reliable transport of passengers and freight over long or short distances in international, domestic or urban environments.



This light rail system in Nottingham (UK) relies also on IEC TC 9 Standards (Photo: Bombardier)

Getting to know Kerry McManama

A mind open to all possibilities



Kerry McManama, the new Executive Secretary and Chief Operating Officer of IECEE, attending the 2013 IEC General Meeting

Aliyah Esmail

e-tech talks to Kerry McManama, the new Executive Secretary and Chief Operating Officer of IECEE (IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components) to find out how he arrived at this point and the challenges he sees in his new role.

Engineering is the choice

e-tech: How did you decide to become an engineer?

McManama: Coming out of high school I didn't really know what I wanted to do. I wasn't sure what field I wanted to pursue or where my passion was. I joined the US Navy and it trained me in electronics and in electricity, specifically as they relate to missile systems and gun fire control systems. I operated and maintained the computers and radars associated with those systems aboard ships.

When I got out of the Navy I was hired by a local college to teach basic electronics. That kept me in the field of electronics. Then I changed jobs and went to work for a US defence contractor. I worked for them for about a year, helping them to design and manufacture electronic countermeasure (radar jamming) equipment. At the time of my first performance evaluation I was told: "well Kerry, you've plateaued already. You're in the top position in terms of your training and you can't go any higher". I decided that I wasn't ready for my career to plateau at that point so I went back to school to get my Bachelor of Science degree in Electrical Engineering (BSEE) from the University of Illinois.

Work that led to Conformity Assessment

McManama: Coming out of university I was hired by UL (Underwriters Laboratories Inc.). I found the work fascinating enough to keep me there for 21 years. It was different all the time. You saw all kinds of products coming through the door. The work was never boring and monotonous and I was able to do a number of different things, both on the technical side and the business, or management, side.

After those 21 years, this job became available. I had greatly enjoyed working with the IEC tangentially in my work at UL. This prospect really excited me as it was a smaller company. UL was about 12 000 people and here we have about a hundred. Going from a large corporation to a smaller company was something I found interesting and alluring. Having worked with Chris Agius as the Chairman of IECEX (IEC System for Certification to Standards Relating to Equipment for Use in

Explosive Atmospheres) I was able to see the type of things that he was doing – business development in the Ex field of Conformity Assessment, working with stakeholders from all around the world – and that was something I wanted to do so I made the decision to try for this job.

Expectations ahead

e-tech: What did you expect when you applied for this job?

McManama: I didn't have any major expectations per se. I wasn't sure that I would be viewed as the right person for the job, but I was hopeful given my past work and my expertise in the industry. I guess my expectation was that I would be able to do the job and do it well otherwise I wouldn't have applied to begin with.

I expect it to be difficult. I expect the learning curve to be long and steep. Coming from a business management and Conformity Assessment background and coming from being the Chairman of IECEX it certainly isn't something that is new to me: I am very familiar with what IECEE is. And I know it is going to be a challenge to do it well – but I think I am up to that challenge.

More to do and more to believe in

e-tech: Why did you want to do this job?

McManama: The vision and mission of the IEC are very interesting to me and I embraced it. This allows me to jump in with both feet, rather than play a tangential role.

Because we're a smaller organization I feel I will be able to provide input into different areas of the organization. I've got my finger on everything here. This is certainly not going to be a job where



Safe electrical products is one of IECEE's main goals

I am just focused on one thing and I am just putting a nut on a bolt on a conveyor belt.

The importance of IECEE

e-tech: Tell me why you think IECEE is important.

McManama: We deal with safety standards and primarily with electrical safety. Electric shocks and electrical fires kill and injure people all around the world every year, as well as cause untold millions of dollars in property damage. IEC International Standards are used to set the minimum bar of what a safe product is.

IECEE Conformity Assessment System sets the bar in terms of the basic requirements for certification and evaluation to IEC International Standards. It means that everybody comes in at the same level. This is hugely important in facilitating international trade and cooperation. Goals for the future

e-tech: When you heard that you had got the job, what things did you set out to achieve?

McManama: I came with an open mind. I didn't have any preconceived notions of what I wanted to do. I am still assessing where everything's at and what's going on. I don't want to make changes arbitrarily or too quickly.

I understand that IECEE has been operating for a decade and a half or more and for the most part it seems to be serving its members well. My desire is not to muck that up. First I want to finish my assessment of where we're at then I'm sure I'll apply my little touch here and there. Sometimes it will be visible and sometimes it won't be visible.

It's a system that has been operating for a long time. Most of the players who have been coming to meetings and participating in working groups have been here for years and years and years. They know every requirement, every comma and period in our Rules and Procedures. I have to get myself to that point so as to be able to be taken seriously and to be able to contribute. Right now I'm doing a lot of listening rather than talking. I would hope that in the near future I will perhaps be able to start putting my mark on things.

New role brings greater responsibility

e-tech: What challenges do you see in your new role?

McManama: There are challenges that come along because of changes to International Standards – and I don't even know if I want to classify them as challenges. Our certification bodies and test laboratories have to comply with

ISO/IEC 17065, *Conformity assessment – Requirements for bodies certifying products, processes and services* and ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*. As International Standards change, the assessments that we perform also necessarily have to change to a certain degree because new requirements now exist. Our documentation has to change, our processes on how we function have to change, and it is a challenge to meet the new International Standards that come on board.

We have to stay up to date with technology. We have our own internal IT challenges that we have to work to improve. Our membership expects us to be efficient and cost effective, and they want us to provide value for the money that they pay to the IEC, and specifically to the IECEE System.

We constantly have to show them that we are providing that value with fast responses to emails and questions and we have to do it in a cost effective way. They're being challenged in their companies to cut costs or be more efficient and they expect the IEC and IECEE to do the same thing. Our challenge is always doing more with less at the same time as we are trying to provide better services and faster responses to the needs of the System. That's the kind of juggling act that is difficult to perform sometimes. And we have to be fair and consistent in how we apply the rules as the Secretary is often the arbiter for various aspects of such rules.

External challenges

McManama: The IEC is a fairly known commodity in the marketplace and so too is the IECEE for the main part. Our biggest challenges are with the differing regulatory systems around the world. Where I, in my position, can step in is in assisting the regulatory agencies with any needs they may

have in terms of regulations and Conformity Assessment as they relate to electrotechnology equipment and components. There have been some successes in doing that, certainly at IECEX.

I think that IEC is viewed as a fair partner, a neutral player in terms of International Standards and Conformity Assessment. Because of that sense of neutrality and the mission and goals of the IEC, the IEC can help open doors to governmental agencies. The fact that we're a non-profit organization and that we're looking to facilitate global trade helps us get through doors and have discussions with regulators and users.

Understanding the technological future

e-tech: What technological challenges do you see in the future of IECEE?
 McManama: It is difficult to predict



Kerry McManama in front of the United Nations in Geneva, Switzerland, when he was Chairman of IECEX

future technological changes. I think our main challenge is that we know change is coming – but sometimes we just don't know where it will occur.

If you had asked me that question 15 years ago, I perhaps would not have

thought of renewable energies. Wind energy, marine energy and solar are things that have grown over the past 15 to 20 years to the point that we're now looking at a new system for those industries.

What's going to happen over the next 15 to 20 years in terms of technology? I'm not sure. If it continues along the line of renewable energies we'll see some new developments in terms of energy storage whether in terms of batteries or some other technique. It's tough to determine what will come in the course of the coming years.

Striving to practise fairness

e-tech: If there is one thing you want people to know about you, what would it be?

McManama: What do I want people to know? I think it's that I'm fair, collaborative and consistent.

Knowledge supports safety in Ex areas

Chris Agius presents at the ATEX Forum in Denmark

Aliyah Esmail

It is important that the people working in explosive areas are competent and have the most up-to-date knowledge. Not having this knowledge could have serious repercussions, including costing lives.

A Forum that educates

The Danish Forum and mailing list was set up nine years ago. It's a network of about 350 participants who are registered on a mailing list and are invited to each Forum. The Forum is held twice a year, once in the Eastern part of Denmark and once in the Western part.

The purpose of the Forum is to give participants a place to exchange experiences and knowledge and urge them to give a presentation on what they do in their company to comply with Ex related regulations in Europe. Much of what is covered involves the health and safety aspects of working in explosive atmospheres: how to work in Ex areas, what should be worn and so on. It also covers the framework of the products encompassed by IEC International Standards through TC (Technical Committee) 31: Equipment for explosive atmospheres, as well as European Standards.

The Forum is to act as a primary contact point in Denmark for those who work in any Ex or explosive area. They might work in the offshore or oil and gas industry, consult in the Ex areas, be a Danish producer of any of a number of different types of equipment, on the railways, in a cement factory (they install their own energy supply based on coal which makes it an explosive area) or as a regulator. As Denmark has a large number of SMEs (small and medium enterprises) there is also a drive to involve them.

"We are focusing on areas like static electricity and others that get less



Chris Agius talks in-depth about IECEx at the Forum in November 2013

attention. Static electricity can make it all go up in the air. The consequences of an accident are major. You can have a plant destroyed, people killed and so on,” says René Nielsen, the manager of the Forum as a result of his position as Senior Consultant in the department of International Leadership and University Cooperation at Danish Standards.

He uses the example of taking a handful of flour, throwing it up in the air and sparking your lighter. Given the right mixture of oxygen and the ignition, you can have a disaster. While this

probably won't happen in an ordinary kitchen, in large industrial bakeries there will be hot surfaces and it's vital that you know how to take proper precautions.

Presentation on IECEx

In his presentation to Forum participants, Chris Agius, the Executive Secretary of IECEx (IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres), dug deeply into the subject of how IECEx can help those

working in the Ex sectors in Denmark to increase safety. Agius explained that in the 1990s, standards, certification and approval régimes that aimed to control the risks inherent to Ex areas differed from one country to the next. This meant that if a manufacturer wanted to sell a product in more than one country, they would have to get approval/certification in each one. For many manufacturers, the need to repeat testing was expensive and time consuming.

Based on industry requests, the IEC developed a unique international System that today covers all of the certification needs of the explosive atmosphere sector. It includes individual devices and systems; location evaluation; inspection; installation; maintenance and repair and assessment of the competence of personnel working in this highly specialized area. One of the key advantages the System offers is that testing and assessment only need to be conducted once and are thereafter accepted by all members of the System.

Agius went on to talk about how IECEx has an open and transparent process and clear rules and that industry is able to provide direct input into the way the System works.

Agius explained that at the beginning IECEx only covered the International certification of Ex equipment. Industry soon realized that these benefits could equally apply to Ex related services such as repair and overhaul as well as to the assessment of the competence of persons that work in Ex areas.

One of the most important aspects of the IECEx System is its “On-Line” Certificates of Conformity. All IECEx Certificates issued by IECEx approved Certification Bodies have the master version in electronic form live on the IECEx website; any paper or downloaded electronic version is



Many surprising industries have potentially Ex environments: sugar refineries; flour mills; and grain silos, to name a few

considered an uncontrolled copy of that master IECEx Certificate. The electronic version of any valid IECEx Certificate is fully accessible to the public and allows instant verification of claims made by a vendor.

A place to discuss Ex issues

Though Agius’ presentation took up a large part of the day, other topics such as how to be sure ATEX (Atmosphères Explosibles) certificates are updated when there is a change in standards and how to deal with gas installations in relation to ATEX regulations were also covered.

“The Forum is an exchange of experience and knowledge. We have people from all sectors of Ex coming to these Forums. When we started out in 2005 we hit on something that people were looking for,” said Nielsen who is

also a member of the IEC SMB/JDMT (Standardization Management Board/ Joint Directives Maintenance Team)

and has been the IEC NC (National Committee) Secretary of Denmark since 1999.



Chris Agius talks to the Danish ATEX Forum about the history of IECEx

Safer cars, smarter drives

Cars and world connect

Aliyah Esmail

Some days it looks like you are going to be stuck in traffic forever. Sometimes it is because traffic volumes have suddenly increased. All you can see is car ahead of car as far as the eye can see. At other times, you hear the squeal of tyres and then you see two cars collide. About 1.24 million people died on the world’s roads in 2010, said the Global Health Observatory of the WHO (World Health Organization). But technology may be able to increase safety or save you from being stuck in traffic sooner than you think.

Cars can talk to each other in the US

In February 2014 the US Department of Transportation’s National Highway



V2V communication technology warns drivers of what is happening on the road

Traffic Safety Administration said that it will start allowing V2V (vehicle-to-vehicle) communication technology.

This will let cars exchange basic safety data, as well as information about road and traffic conditions and vehicle-

specific information such as speed and position, up to ten times per second.

Signals from other cars, sent through a modified version of Wi-Fi, can help flag up potential risks. This technology may

help people avoid most of the crashes involving two or more cars and has been shown to increase safety in the real world as well as in test environments. Though V2V does send out warnings, it does not take over vehicle systems such as braking or steering.

Tested on the street

In August 2012, UMTRI (University of Michigan's Transportation Research Institute) installed built-in connected technology into 2 500 cars in Ann Arbor, Michigan. Another 300 cars as well as some motorcycles, buses and commercial trucks had communications devices added into them that allowed them to communicate with each other and the road infrastructure. This test lasted for a year and used cameras outside and inside the vehicles to see how drivers reacted to warnings.

Eight major car companies participated in the tests. They used different warning systems, including red LED lights on the bottom of the windscreen, alarms and vibrating seats as well as graphics in the instrument panel. The test also looked at the interoperability of V2V technology in vehicles from different manufacturers and suppliers.

Car-to-x communication in Germany

In June 2013, the final phase of the simTD (Safe Intelligent Mobility – Test Area Germany) project began examining the “first social network for automobiles”. One hundred and twenty vehicles and three motorcycles were tested in a venture that linked vehicles and infrastructure in an electronic network with the aim of avoiding traffic jams and accidents and to report on a range of other applications. The overall project, which began back in 2008, is funded by the German Government. The research element is headed by Daimler Research and Advance Development while a number of other companies are also participating, looking at the

functionality, efficacy and feasibility for everyday use of car-to-x communication – a combination of V2V and vehicle-to-infrastructure communication – under real driving conditions.

The radio technology developed for this system is based on the wireless local area network. Its purpose is to increase safety as well as to minimize traffic, which will hopefully save drivers time on the road, lower their fuel and vehicle maintenance costs and reduce CO₂ emissions.

Long-term plan

The launch plan for simTD is a voluntary one. Starting in 2015 the simTD technology will be used near road construction sites as part of a public-private partnership signed up to by the Austrian, German and Dutch transport/infrastructure ministries and called “Cooperative ITS Corridor Rotterdam - Frankfurt am Main – Vienna”.

The trials will benefit drivers by showing them their travel history and the congestion on the routes they are taking and will help them understand the best strategies to employ during rush hour. It can warn of traffic delays but it is not meant to warn drivers of impending accidents.

New technologies require safer components

To ensure that the technologies being developed for vehicles around the world are reliable, IECQ (IEC Quality Assessment System for Electronic Components) created a programme that gives the automotive industry a standardized way of testing the components in those technologies. IECQ AQP (Automotive Qualification Programme) helps automotive manufacturers avoid multiple tests and related costs. It can also be used by independent, third-party certification bodies to make sure that components meet automotive industry standards.



With V2V and V2I technology helping drivers plan their trips, hopefully traffic jams will become a thing of the past

As the technologies that allow cars to talk to each other and to infrastructure take off, with multiple similar projects running throughout the world, people will come to rely on the warnings their car is giving them. If the components that underpin these technologies are not certified by IECQ AQP, there will be no way of knowing whether or not they will fail at a crucial moment.

Organizations that hold IECQ Automotive Qualification Programme Certification show the international market that they and their facilities comply with the requirements of the IECQ System. These organizations are also demonstrating that they comply with the relevant declared technical Standards and specifications for their scope of activity.

The future may bring us cars that help keep us safe and speed up our trips during rush hour but IECQ will continue to ensure that the electronic and electrical components in our vehicles do not fail us when we need them most.



These technologies allow cars to communicate about sudden braking and other incidents that could affect you while you are driving

Smart energy for Africa

First International Africa Smart Grid Forum next May in Abidjan, Côte d'Ivoire



The Africa Smart Grid Forum has a dedicated website in English and in French where you can register for the event

Claire Marchand

While access to electricity is a given in industrialized countries, the situation is very different in large parts of the developing world, and so also in Africa, where vast areas have only limited and sporadic energy supply or are still completely off the grid. To continue and increase its economic development, Africa needs to upgrade existing electrical infrastructures or in some cases build networks from scratch to meet the ever growing demand.

The Smart Grid approach

Today Africa has a unique opportunity to build systems and networks that use the most recent technologies and include renewable power generation. The continent can benefit from recent developments in the industrialized world and put in place smart systems that integrate renewable energies – solar and hydropower for instance – and state-of-the-art ICTs (information and communications technologies).

This move towards a Smart Grid approach is bound to have in-depth consequences on the interaction and communication between stakeholders,

such as utilities, consumers and telecommunications and ICT companies.

What is at stake?

Smart Grids for whom, why and what for? What are the technological barriers to the Smart Grid development? Which investments are necessary to deploy these solutions? How to manage the decision-making hierarchy between all stakeholders? Which standards are applicable to these networks? What will be the benefits for Africa?

These questions, and many more, will be addressed during the first international *Africa Smart Grid Forum 2014*, which will take place in Abidjan, Côte d'Ivoire, from 14 to 16 May 2014.

First international Africa Smart Grid Forum

Entitled *The Smart Grids, a solution for emerging Africa*, the Forum will bring together renowned Smart Grid experts from around the world who will be able to share their experience and expertise with all participants.

The event is jointly organized by CIE (Compagnie Ivoirienne d'Electricité), CODINORM (Côte d'Ivoire national

standards body), AFSEC (African Electrotechnical Standardization Commission) and APUA (Association of Power Utilities of Africa).

The Forum is held in collaboration and partnership with the IEC, CENELEC (European Committee for Electrotechnical Standardization), DKE (German Commission for Electrical, Electronic & Information Technologies of DIN and VDE), SGCC (State Grid Corporation of China), KATS (Korean Agency for Technology & Standards) and AFREC/AU (African Energy Commission of the African Union).

Save the date! Register!

To register and obtain more information on this event, please visit the Africa Smart Grid Forum at: <http://africasmartgridforum2014.org/en/index.php> (website available in French as well).



A solar farm in Rustenburg, North West Province, South Africa



The Naute dam in Namibia

Reaching out

Using social media to increase awareness of IEC work



The IEC has embraced the changing communications landscape and is present on all major social media channels

Zoé Smart

With the introduction of social media to the communications landscape the way organizations interact with their stakeholders has changed irrevocably. The IEC has risen to the challenge with aplomb.

Reaching out to audiences...

Today more than ever, people expect to be able to connect with the brands that interest them on the social media channels on which they are active, rather than having to spend time looking for a website or waiting to

be informed of latest news through targeted communications such as news releases.



Today content is shared on multiple networks

From early on the IEC has been responsive to the changing communications landscape by reaching out to audiences and sharing information on social media platforms it has deemed appropriate. As a result the IEC is today present on all of the top 5 social media channels globally; LinkedIn, Facebook, Twitter, Google+ and YouTube.

...with tailored content

One of the major consequences of the expansion of social media is that content is shared on multiple



Key IEC social media milestones

networks and often without the organization's awareness, in what is called the 'ripple effect'. Because a lot of the conversations take place

Key milestones

With nearly one in four people worldwide estimated to be using social networks, the IEC is keen to keep abreast of the latest developments in social media effectiveness by following industry insights on best practice. From setting up its IEC Facebook page in 2008 to reaching an audience of 36 800 with a single post in late 2013, here are some of the key IEC social media milestones:

- Facebook and YouTube accounts created in 2008
- Joined LinkedIn in early 2010
- #StandardsTuesday hashtag,

celebrating standardization work, introduced in February 2012

- Global Visions mobile app launched in January 2013
- Reached 3 000 Facebook fans in September 2013. Like us here: <https://www.facebook.com/InternationalElectrotechnicalCommission>
- 10 000 members on LinkedIn in October 2013. Join the conversation on 'The Electrotechnical Standards Group' on LinkedIn here: <http://www.linkedin.com/groups?mostPopular=&gid=2725372>

out of earshot, the type of content being shared is of utmost importance.

With businesses and those working in electrotechnology and related fields being the organization's core audience, the IEC aims to share content that increases awareness of its work and the importance of standardization. It does so through

actively engaging with stakeholders rather than talking at them and sharing content, both existing and IEC-produced, that will arouse interest and stimulate further discussion. In the case of the IEC LinkedIn group, which boasts 12 316 members to date, content is predominantly self-generated and reflects the interests of the professionals initiating them.

Formula E approaches the starting grid

Electric vehicles in the motor-racing spotlight

Janice Blondeau

The inaugural season of the world's first fully-electric racing series, Formula E, will run from September 2014 to June 2015.

Ten teams, ten cities

For the first season, 10 teams with two drivers each will compete in 10 cities across the world. Races are planned for Beijing, China; Putrajaya, Malaysia; Rio de Janeiro, Brazil; Punta del Este, Uruguay; Buenos Aires, Argentina;



The Formula E series gives the opportunity to showcase electrical vehicle innovations in a racing environment (Photo: Formula E)



The Spark-Renault SRT-01E will be used by all teams in the first season (Photo: Formula E)

Los Angeles and Miami, USA; Monte Carlo, Monaco; Berlin, Germany and London, UK.

One car for 2014

The Spark-Renault SRT-01E is the first car to be homologated by the FIA. For the 2014-2015 season, each team will run four Spark-Renault SRT-01E Formula E cars, two per driver. The cars and teams will be based at a purpose-built central workshop in the UK. From season two, Formula E will become an open championship with teams designing and developing their own cars, in accordance to the technical specifications set out by the FIA.

Power

The traction battery is a RESS (Rechargeable Energy Storage System), supplying electric energy to the power circuit and so to the

traction motor. The maximum weight of the Battery Cells and/or Capacitor of the RESS must not be more than 200 kg. The amount of energy that can be delivered to the MGU (Motor Generator Unit) by the RESS is limited to 30 kWh. This will be permanently monitored by the FIA.

Cars will accelerate from 0 kph to 100 kph in an estimated time of 3 seconds, with a maximum speed of 220 kph. Maximum power will be available during practice and qualifying sessions while during races, power-saving mode will apply. A 'Push-to-Pass' system will temporarily allow maximum power for a limited time during a race.

Innovation showcase

The Formula E series will provide car manufacturers and constructors with the opportunity to showcase their electrical energy innovations

in a racing environment. Organizers hope that this multi-make series will foster research and development around the electric vehicle and push the boundaries of current technology.

A long-term aim of Formula E is to accelerate the market penetration of electric vehicles by appealing to new audiences.



Formula E hopes to accelerate the market penetration of EVs by appealing to new audiences worldwide

Nominations and extensions

TC 11 welcomes its new Chairman



Giovanni Pirovano is the new Chairman of TC 11

Zoé Smart

SMB (Standardization Management Board) has approved the nomination of Giovanni Pirovano as Chairman of IEC TC 11: Overhead lines for the period 1 November 2013 to 31 October 2019.

About Giovanni Pirovano

Currently head of the research group 'Electrical Technologies and Components' for RSE (Ricerca sul Sistema Energetico) SpA, Pirovano has no less than 25 years' experience in research, testing, consulting and standardization activities on overhead lines and relevant components.

He has provided his expertise as consultant for a number of international bodies, such as UNMIK (United Nations Interim Administration Mission in Kosovo) and the Arab Fund for Economic and Social Development and is author of a large number of technical papers.

He takes over as Chairman of TC 11 from Romeo Rendina.



TC 18 prepares standards for electrical installations and equipment of ships and of mobile and fixed offshore units

Extensions of terms of office and new member to ACEE

SMB has approved the extension of term of office of Alasdair M Anderson as Chairman of TC 18: Electrical installations of ships and of mobile and fixed offshore units. Anderson's new mandate runs from 1 December 2013 to 30 November 2016.

The SMB has also approved the extension of the term of office of

Jos Remy as Chairman of TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology, for the period 2014-02-01 to 2017-01-31.

Philippe Volletas has been approved by SMB as TC 23: Electrical accessories, member to ACEE (Advisory Committee on Energy Efficiency).



ACEE coordinates IEC TC activities related to energy efficiency

Nanotechnology: a key to solar energy and energy storage

New IEC and Fraunhofer ISI study finds it will bring significant benefits to energy sector

Janice Blondeau

Nanotechnology will bring significant benefits to the energy sector, especially to energy storage and solar energy, a new study from the IEC and the Fraunhofer Institute for Systems and Innovation Research ISI has found. Improved materials efficiency and reduced manufacturing costs are just two of the real economic benefits that nanotechnology already brings these fields and that's only the beginning.

Into the nano future...

Thanks to continued development of nanotechnology, battery storage capacity could be extended, solar cells could be produced cheaper, and the lifetime of solar cells or batteries for electric cars could be increased.

In the study *Nanotechnology in the sectors of solar energy and energy storage* commissioned by the IEC, the Fraunhofer Institute for Systems and Innovation Research ISI found that there is a whole range of nanomaterials

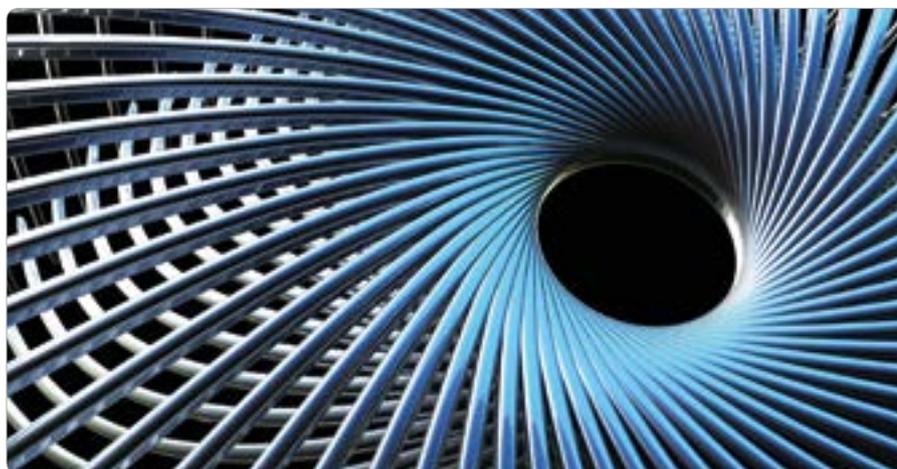


This study found that in some areas nanotechnology may even be a key to success

which will gain importance as technology continues to advance. The Technology Report *Nanotechnology in the sectors of solar energy and energy storage* is available on the IEC website.

The rise of nanomaterials

The study found that the following nanomaterial technologies will be of particular importance: “organic and printed electronics”, “nano-coatings”, “nano-composites”, “nano-fluids”, “nano-catalysts”, “nanocarbons”



New nanomaterial technologies will be of growing importance to energy storage and solar energy

and “nano-electrodes”. These seven technology profiles form the basis for two comprehensive roadmaps in the technical report.

A key to success

Commissioning this study to evaluate the potential of nanotechnologies and the future role of nanomaterials in addressing the energy challenge helps the IEC to understand the kind of work it needs to undertake to enable the broad roll out of these technologies. Against the backdrop of an anticipated 30% increase of global energy demand by 2035 and the significant expansion of renewable energy coming into the grid, the study has found that nanotechnologies including new nanomaterials, could be a key to successful renewable energy and energy storage integration.

Large-scale application in solar power generation and energy storage

Dr Björn P. Moller, project leader of this study at Fraunhofer ISI is convinced that everything points to its large-scale application in solar power generation and energy storage, unlike many other fields where nanotechnology has been unable to make a break-through. Moller said, “It can be assumed that in 2035 the share of fossil fuels in global energy production will have decreased to 75%. This implies that renewable energy will need to contribute significantly more to the overall energy generation. It is therefore crucially important that key technologies such as solar cells are further developed with the help of nanotechnology and that energy storage is improved.” “In some areas

nanotechnology may even be a key to success. There is great potential for nanotechnology to help to mitigate the intermittency of renewable energy," Moller said.

In practical terms

A practical example is through the use of nanotechnology, the light and energy generation of crystalline silicon solar cells or organic solar cells can already be enabled or significantly increased. Their manufacturing also requires less material and is more cost-efficient.

In addition, energy storage capacity will significantly improve with the use of nanomaterials for lithium-ion batteries. This is by far the most important battery technology for energy storage since the early 1990s. It is especially important in view of the constantly increasing demand for electric vehicles, whose success is also directly linked to battery performance and resulting range extension.

Resource for TCs' ongoing work

The work of several IEC TCs (Technical Committees) might be impacted by the findings of this study. The TCs

that work in this area are TC 113: Nanotechnology standardization for electrical and electronic products and systems, TC 117: Solar thermal electric plants, TC 82: Solar photovoltaic energy systems, TC 120: Electrical Energy Storage (EES) Systems and TC 21: Secondary cells and batteries, as well as others.

MSB market watch

This study was commissioned as part of the market watch that the MSB (Market Strategy Board) has put in place to know in advance what kind of technology will be important to IEC in the future. The Technical Report of the study *Nanotechnology in the sectors of solar energy and energy storage* will be useful for those planning the use of solar energy and storage, whether they make products, use those products to generate and store electricity, or organize and regulate the use of the electric energy produced.

About the Fraunhofer Institute for Systems and Innovation Research ISI

The Fraunhofer Institute for Systems and Innovation Research ISI analyzes



The future role of nanotechnology and these new materials will be vital in addressing the energy challenge (Photo: Siemens)

emergence and effects of innovation. We explore the short- and long-term developments of innovation processes and the societal impact of new technologies and services. On this basis, we provide our clients from industry, politics and science policy recommendations and perspectives for key decisions. Our expertise lies in the profound scientific expertise as well as an interdisciplinary and systemic research approach. www.isi.fraunhofer.de

Material declaration Standard goes global

European, Japanese and US bodies recommend adoption of IEC Standard

Morand Fachot

Every electrotechnical product has an environmental impact over its entire life cycle, from raw material acquisition, to the manufacture, distribution, use, maintenance, re-use and end of life of its components, and all of this across borders. An IEC International Standard for the material declaration for products of and for the electrotechnical

industry, and its associated database have been adopted by European, Japanese and US industries.

Landmark Standard

Electrical and electronic products are manufactured using many substances; some, for instance lead, mercury and cadmium, are regulated and must be reported.



Compact fluorescent lights contain small quantities of mercury



Lead is often used in batteries

IEC TC (Technical Committee) 111: Environmental standardization for electrical and electronic products and systems, published IEC 62474, *Material Declaration for Products of and for the Electrotechnical Industry*, in March 2012.

This landmark standard was designed to help the industry track and declare specific information about the material composition of its products.

It is aimed at harmonizing requirements across the supply chain and at improving economic efficiencies; it defines requirements for the exchange of material composition data and provides those for material declarations. IEC 62474 benefits the electrotechnical industry by establishing the requirements for reporting substances and materials, standardizing protocols, and facilitating the transfer and processing of data.

Associated database facilitates information exchange

The IEC 62474 “database” accompanies the IEC 62474 standard. This database, which is maintained by a validation team, consists of a list of substances, substance groups and common material classes to declare, with reportable applications and

reporting thresholds. The database also includes information for software developers who are working on IT tools for material declaration that conforms to the standard.

IEC 62474 specifies the criteria to add, change or delete a given substance, substance group or material class from the database. There are three basic criteria for inclusion in the IEC 62474 database: “currently regulated”, “for information only” and “for assessment”.

Simultaneous adoption across continents

On 21 January 2014 three bodies, CEA (Consumer Electronics Association), DIGITALEUROPE and the JGPSSI (Japanese Green Procurement Survey Standardization Initiative) announced that IEC 62474 was now the recommended electrotechnical industry’s material declaration standard. The existing JIG (Joint Industry Guide) 101 they used previously was “now several years out of date with global regulations and, consequently, should be considered officially obsolete,” a joint press release by the three organizations indicated, adding: “IEC 62474 is now the recommended electrotechnical industry’s material declaration standard.”

The US-based CEA brings together 2 000 companies within the consumer technology industry. It “functions as a vital connection between companies, retailers and consumers to develop a unified technology roadmap and tackles any impasses along the way.”

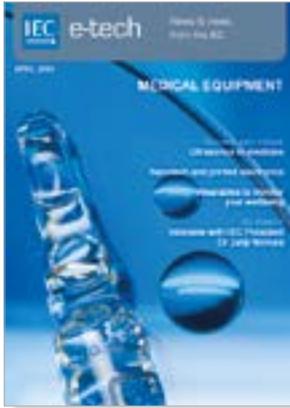
DIGITALEUROPE “the voice of the European digital technology industry” represents more than 10 000 companies all over Europe with more than 2 million employees and over EUR 1 000 billion in revenues.

Japan’s JGPSII is a voluntary organization created with the purpose of standardizing substances contained in parts and materials of equipment in electrical and electronic products through effective survey methods. Back in June 2012 it announced it would be dissolved and its activities transferred to a subcommittee of the Japanese IEC TC 111 committee following publication of IEC 62474.

Adoption of this International Standard and its associated database by these three influential international bodies will help manufacturers track and declare detailed and harmonized information about the material composition of their products and the possible presence of restricted substances they contain. It should also help ensure that these products conform to legal requirements, thereby supporting trade and reducing the possible negative environmental impact of many electrotechnical components and products.



Old IT equipment may contain regulated substances



Medical equipment

Healthcare is undergoing nothing short of a revolution with key advances in long-established technologies and major development in new areas which all depend on electrotechnology. From X-ray imaging and therapies techniques, first discovered in the late 19th and early 20th centuries, to developments in ultrasonics diagnosis and treatment equipment and, more recently the introduction of robotics, printed electronics and 3D printing in the medical environment, improvement in the health of patients has become more reliant than ever on electromedical equipment. A number of IEC TCs work on developing standards for such equipment, with one IEC TC in particular focusing on basic and particular safety requirements.

One related technology that is set to experience a major expansion is that of wearable health monitoring and wellness equipment, which relies also on standards prepared by a number of IEC TCs.



Photo: iHealth



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News & views from the IEC

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