



## TRANSPORTATION

INDUSTRY & TECHNOLOGY

### Electric vehicles

Batteries of energy

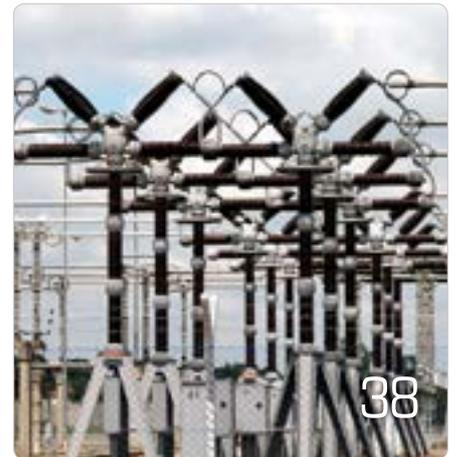
### 2011 Geneva Motor Show

Fully Networked Car  
Managing the distracted driver

FAMILY

### Nominations open for Lord Kelvin Award

Netherlands celebrate their  
centenary



19 Curbing driver distraction 26 How far will it go? Powering the electric vehicle 29 Alternatives to chemical batteries in transportation 37 IEC TC 9 holds 50<sup>th</sup> meeting in China 38 Updating Smart Grid methodology 40 EV propulsion - Performance and reliability testing

## Focus of the month: Transportation

The price of oil continues to rise – it hit almost \$120 in March 2011. As people become more conscious of the implications of climate change, so the motor industry looks to the EV (electric vehicle) as an alternative means of transport both for personal and for public use.

### IEC WORLD

Electrified transport	3
EVs depend on modernization of the grid	4
CANENA focusing on the future	5
2011 nominations for the Lord Kelvin Award open	7
Global relevance	8
Centenary celebrations for the IEC National Committee of the Netherlands	9

### CONFORMITY ASSESSMENT

IECEE keeps engines running with safety and performance certification of batteries	11
IECEX Schemes help reduce risks	12
United Nations endorses IEC with a regulatory framework for Ex areas	14
IECQ helps make travelling safer	15
<b>INDUSTRY SPOTLIGHT</b>	
EVs key to sustainable individual transportation	17
Curbing driver distraction	19
Electric vehicles: The first 50 years of early trials and triumphs	21

### TECHNOLOGY FOCUS

Power on the go – the electric vehicle and its battery	23
How far will it go?	26
Water and heat	29
<b>IEC FAMILY UPDATE</b>	
Nominations	33
<b>TECHNICAL COMMITTEE</b>	
Plug them in and move them on!	36
IEC TC 9 holds 50 <sup>th</sup> meeting in China	37
Updating Smart Grid methodology	38
<b>IN STORE</b>	
Performance and reliability testing for EV propulsion	40
Send it to a friend	41
From breadcrumbs to IEC NC pages	42

# Editorial

## Electrified transport



Philippa Martin-King,  
Managing Editor e-tech.

**The price of oil continues to rise – it hit almost \$120 in March 2011. As people become more conscious of the implications of climate change, so the motor industry looks to the EV (electric vehicle) as an alternative means of transport both for personal and for public use.**



Experimental electric  
straddling bus



Drive for 50 km on 10 minutes'  
charging

At present, transport uses only 1 % of the electricity produced globally. But before EVs can become widespread, there are a number of issues to be resolved. Energy distribution for the EV is a complex matter that involves not only the relevant hardware to allow fast connection and charge retention with efficient, safe and standardized plugs, sockets and batteries, but also the management of the electricity itself. For electric vehicles to become mainstream the supporting infrastructure needs to facilitate longer distance driving and fast recharging. It's a paradoxical situation because until there is sufficient demand for external out-of-the-house support, infrastructure is likely to remain sparse. Which will come first: the demand or the offer?

### Charging from and feeding back to the grid

Concerning the charging itself how does one deal with sudden demand during peak electricity use hours? How can electricity demands be staggered to rule out fluctuation and take advantage of availability during slack hours? What possibilities exist or can be developed to feed excess battery-stored EV energy back into the grid when it is not needed by the vehicle?

The stakes in EVs are high and growing. The motor industry considers EVs as a key solution to provide sustainable transportation for people and merchandise while reducing emissions and dependency on fossil fuel. Manufacturers are constantly announcing new technical developments that, in one way or another, relate to electric vehicles.

One of the challenges behind the electric car, or indeed any EV, be it a bicycle, train or bus, is not so much in its use or in the storage of the electricity itself, but in its ability to deal with the distribution of the energy so that it is readily available, but in a way that does not impact the grid. The complexity of distribution depends on hardware, such as batteries and connectors, but also involves intelligence in terms of dealing with fluctuations of demand for charging, and possible energy feedback into the grid.

### EVs a highlight at the 2011 Geneva International Motor Show

EVs were one of the highlights of this year's Geneva International Motor Show that attracted some 735 000 visitors. Most of the exhibitors, including Rolls Royce with its EE, the Experimental Electric Phantom, were proposing fully electric or hybrid models. At the same time, manufacturers had set up charging station demonstrations with explanations of fast-charge and medium-charge modules as solutions to overcome battery storage shortcomings.

### Fully Networked Car workshop

For the sixth time, the IEC participated in the 6<sup>th</sup> WSC (World Standards Cooperation) Fully Networked Car workshop in collaboration with its partner organizations, ISO (International Organization for Standardization) and ITU (International Telecommunication Union), [See separate article on *Driver distraction* in this month's *e-tech*]. The opening speech of the workshop, which brought together experts in ICT (Information and Communication Technologies), environmental agencies, automotive directorates and industries from all over the world, was given by IEC Vice-President Enno Liess [See separate article on *the necessity of Smart Grids for EVs* in this month's *e-tech*].

In terms of energy efficiency and CO<sub>2</sub> (carbon dioxide) reduction measures, EVs offer tremendous potential. Issue 03/2011 of *e-tech* looks at some of the challenges facing the EV both in terms of distribution and availability of electric energy across the grid and as a solution to some of the environmental problems faced by the world today.

# Smart Grid crucial for EVs

## International Motor Show – 6<sup>th</sup> Fully Networked Car workshop

**The Geneva International Motor Show was the opportunity, for the sixth year running, for the IEC, ITU and ISO under the auspices of the WSC (World Standards Cooperation), to bring together key players involved in the development of ICT (Information and Communication Technologies) and standards in the automotive industry at the 6<sup>th</sup> Fully Networked Car workshop. While car manufacturers enthusiastically presented a variety of EVs (Electric Vehicles) at the Show, both IEC Vice-President Enno Liess and Hans-Georg Frischkorn, Director for Technology and Environment, VDA (Verband der Automobilindustrie), the German Association of the Automotive Industry, warned that the successful roll-out of those vehicles was dependent on the modernization of the electricity grid infrastructure.**

Held over two days during the 2<sup>nd</sup> Press Day and the first public day of the motor show, the Fully Networked Car event represented an unequalled opportunity for experts and executives from the automotive industry, ICT community, governments, research and development



*IEC Vice-President, Enno Liess gives the opening speech at the workshop.*

institutes, and academia to share their vision and strategies.

IEC Vice-President, Enno Liess, gave the opening speech at the workshop.

### **EV standardization development increasing**

International electrotechnical standards are important not only for the batteries and charging systems of EVs (electrical vehicles), but also for the reliable supply of electric power via Smart Grids. “The car industry considers EVs as one of

the key solutions for maintaining sustainable individual transportation”, said Liess. He underlined how the Geneva Motor Show was exhibiting numerous EV-related launches, that unlike with more traditional cars, are entirely standalone. According to Liess however, EVs are not a stand-alone proposition. “Producing the car will not be enough”, he said. “The broad roll-out of EVs will require significant investment into the energy and charging infrastructure.”

### **Smart Grid and charging structure**

If governments too are increasingly looking to electrified transportation as one of the tools to fight climate change – the transportation sector contributes roughly 20 % to global CO<sub>2</sub> (carbon dioxide) emissions – there will be an impact on existing electricity networks. Liess explained how until now, with only 1 % of world electricity produced being used in transportation, little communication had taken place at an international level between the different stakeholders. “The car is only one element in a huge system and that’s why all relevant stakeholders need to sit together, to better understand each other’s needs and roles,” he said.

### **e8 – leading electricity companies prioritize at an international level**

Liess summarized the outcome of the discussions that took place at the IEC-e8 strategic Round Table on EVs in January 2010 among automotive manufacturers, electricity equipment suppliers and utilities to coordinate the work needed for EV development [see the January/February 2010 *e-tech* article]. “The IEC, in cooperation with e8, a global organization of 10 world-leading electricity companies, brought together major stakeholders that need to collaborate to accelerate the global roll-out of electric vehicles,” he said. “For



*The Fully Networked Car workshop was organized co-jointly by the WSC*

the first time, the industries that will need to work together had the opportunity to discuss their needs and priorities at the international level.”

### EV as a potential energy store

Since an EV connected to the grid has the potential to feed back into the grid any energy that has not been used by the EV itself, there is a need for specific safety and technical Smart Grid standards. “The IEC is involved in all major Smart Grid projects around the world”, said Liess. “It delivers the large majority of technical standards that are needed to update legacy infrastructures, one of the pre-conditions to integrate renewable sources

of energy and to enable mass charging of electric vehicles.”

He underlined how International Standards were important. “Together, the IEC, ISO (International Organization for Standardization) and ITU (International Telecommunication Union) provide a virtually seamless international system of standardization that brings concrete benefits to the car industry in terms of global technology roll-out, efficiency and savings,” he said. “Drivers have access to widely compatible, efficient and cost-effective technologies, and governments are able to protect the safety of their citizens and the environment.”



The WSC is made up of the three sister standardization organizations IEC, ISO and ITU

## CANENA

Focusing on the future

**CANENA, the Council for the Harmonization of Electrotechnical Standards of the Nations of the Americas, held its annual meeting on 2-3 March 2011 in San Antonio, Texas, US (United States).**

### CANENA – a forum for harmonization discussions

Founded in 1992, CANENA aims to foster the harmonization of electrotechnical product standards, CA (Conformity Assessment) test requirements, and electrical codes among all democracies of the Western Hemisphere. CANENA is not a standards developing organization but provides a forum for harmonization discussions among its various



CANENA is a volunteer based organization

organizations, manufacturers, CA bodies and individual participants that make up its membership.

The annual meeting was an opportunity for attendees to discuss best practices, energy efficiency harmonization and some of the present major standardization activities in the various member regions.

### IEC activities key to industry and Conformity Assessment

Former IEC Vice-President Frank Kitzantides provided an update on some of the key topics and activities of the IEC, underlining how the International Standards needed by industry are now produced in an average of 30 months. Speeding up the process even further, he said, “so as to accommodate for the needs of fast-moving markets, the IEC works with all relevant organizations to bring *de facto* industry standards into the worldwide consensus process.”

Kitzantides explained how the IEC CA Systems were also growing in



Former IEC Vice-President, Frank Kitzantides

parallel with the standardization activities and how more countries and laboratories were joining and participating in the scheme.

### New partnerships

Increasingly, the IEC is also engaging with new partners in specific areas to increase the efficiency and awareness of its work. “In October 2010”, he said, “the IEC signed a tripartite agreement with the IAF (International Accreditation Forum) and ILAC (International Laboratory Accreditation Cooperation). The aim of this agreement is to further increase the

efficiency of IEC Conformity Assessment Systems while helping testing laboratories to save time and money.”

**Energy efficiency – the IEC white paper**

Following the publication of its white paper addressing the global Energy Challenge, the IEC had begun negotiations for cooperation with the IEA (International Energy Agency),” Kitzantides said. “The aim of the cooperation with the IEA is to link the IEC MSB (Market Strategy Board) recommendations directly to concrete IEA work. In this context, the IEC will bring on board its solid technical know-how to ensure global interoperability and compatibility of systems and devices.” Explaining how energy efficiency and an intelligent use of electrical energy were key focuses for the coming years, he continued, “The scope of the MSB white paper is exceptional as this is the first report that looks at the whole energy chain and pinpoints what needs to be altered to achieve ambitious carbon emissions targets of 20 % by 2020.”

**Smart Grids**

Kitzantides cited the Smart Grid as another important area of IEC work. “Smart Grids are being built everywhere right now,” he said. “National and regional grids will need to be able to communicate with each other across borders and even continents, so the need for standards is largely understood.”

He explained how this context had given rise to the IEC’s Smart Grid roadmap, which was being adopted by many others as the basis for their own, together with the great number of IEC technical standards needed to update legacy infrastructures. As an example of this, he mentioned the US. “The IEC cooperates closely with NIST, the US National Institute for Standards, and the first five foundational standards that have been approved for the US Smart Grid are all IEC International Standards.”

**A need to increase the understanding of the value of standards**

At present, while there is certainly understanding of the value of standards, no ensured, systematic approach exists

to increase future participation in the standardization process. Few business schools include standardization in their curricula, and many business leaders are disinclined to include the cost of sending experts to participate in development work in their budgets.

**IEC Young Professionals’ Programme**

Kitzantides outlined the IEC’s Young Professionals’ Programme, a focused effort to involve tomorrow’s experts in the world of standardization early on in their career. “At the IEC we believe it is important to build up the next generation of standards professionals and support young engineers, technicians and managers to raise their understanding of and interest in standardization and Conformity Assessment,” he said. “That’s why we have put in place the Young Professionals’ Programme.”

The programme offers participants an international networking platform where they can meet other young professionals and exchange ideas. It provides them with the opportunity to get involved in shaping the future of international standardization and CA.

Kitzantides explained how some IEC NCs (National Committees) were now using the Young Professionals’ Programme as a marketing tool to promote their

own work and encourage industry participation. “They recognize the need to start their succession planning now,” he said, “preparing the national experts and leaders of tomorrow, so that their country continues to have its say in the international arena in the years to come. We hope many more countries will follow their lead.”

**IEC Global Visions**

There are cases where CEOs of leading companies have understood the competitive advantage of participating in the standardization process, and the IEC has recorded testimonies to this effect. Kitzantides showed attendees at CANENA extracts from the IEC Global Visions series of videos where leading executives talk of their conviction, both financially and technically, as to the benefits of being a part of the process.

“There is an increasing body of evidence that in an era of shrinking product development cycles, participation in standard setting can translate into a significant competitive advantage,” said Kitzantides. “International standards increasingly dictate access to global markets and enable companies to build products that are accepted worldwide. CEOs of companies who already participate in standardization work understand this.”



*The IEC Young Professionals’ Programme*

# Lord Kelvin Award

2011 nominations open

**Created and first granted in 1995, the pre-eminent Lord Kelvin Award is named after the IEC's distinguished first President. It is the IEC's highest tribute and though not necessarily always awarded each year, is only granted to a maximum of three outstanding individuals in any one year, in recognition of their outstanding long-term technical contributions to the IEC's work.**

## Major role played in helping technical work evolve

Those honoured must still be active in the IEC and will have contributed significantly to the IEC over a substantial number of years, particularly through their leadership and technical contributions to international electrotechnical standardization and related activities. The accolade recognizes the major role that a person has played in helping technical work evolve, or in developing and promoting the IEC CA (Conformity Assessment) systems, to the extent that their contribution has had a considerable impact on industry or commerce.

## Who can nominate

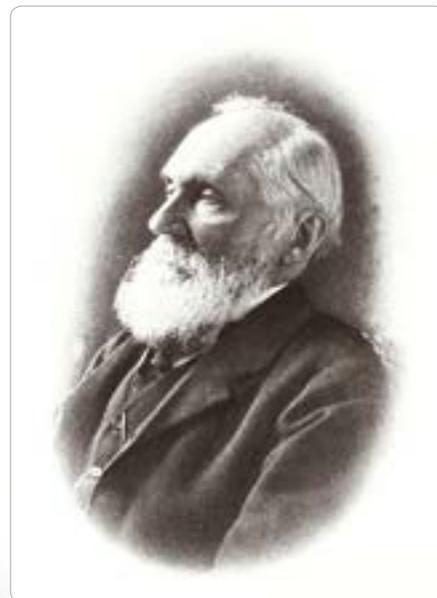
As is fitting for the IEC's most distinguished Award, nominations may be made by IEC NCs (National Committees), TC (Technical Committee) and SC (Subcommittee) Chairmen, and members of the CB (Council Board), SMB (Standardization Management Board) and CAB (Conformity Assessment Board), irrespective of the nationality of the nominee.

Laureates are presented with their Lord Kelvin Award by the IEC President in the presence of a maximum number of peers and colleagues during the IEC General Meeting, usually either at the Council meeting or at the Host Committee's dinner for Presidents, Chairmen and Secretaries.

Full details of nomination criteria and the relevant procedures can be found in the password-protected AC13/2011 on the IEC website.

## Submission date

The deadline for nominations is 6 May 2011.



*Lord Kelvin was the first President of the IEC*



*Laureates receive a gold medal...*



*...and a golden pin*

# Global relevance

IEC Global Visions – broad participation results in better standards

**In this latest IEC Global Visions interview, Keith Nosbush, Chairman and President of Rockwell Automation, the world's largest industrial automation and information company, shares why his organization participates in IEC standardization work and why he encourages other companies to join the process to further increase the quality and relevance of IEC International Standards.**



*See interviews with other CEOs and CTOs of global companies*

### Increased efficiency

The most important trend in manufacturing today is the transformation of IT (information technology)-connected manufacturing to an optimized plant and

supply network. This trend is motivated by three drivers: the need for global competitiveness, an agile supply chain and sustainability. Resources are finite; both in terms of raw materials and fuels, and energy costs are volatile. Manufacturers need to explore new ways to produce, using less raw material and energy and reusing waste to reduce landfills. In short: production processes need to become more efficient.

Rockwell offers a multitude of innovative services in the area of emission reduction, recycling and waste management. Rockwell's participation in IEC standardization helps the company to develop standards that are globally recognized. This is very important for a multinational automation supplier with a global customer base; it enables Rockwell Automation to provide consistency and be more productive and efficient.

### Personal involvement in IEC standardization

Nosbush's personal experience in the IEC may well be the reason why he fully supports his company's participation. Says Nosbush: "I've had personal involvement in the standards working group as a convener. It was very evident to me that being part of the standards organization, and driving towards a global standard created more opportunities

for us as a company. It enabled multiple suppliers to work together to create larger markets. This in turn generated faster adoption of technology and therefore created larger opportunities for all of us to go after. We also were able to convene with all of the experts on a subject area, and to take the best practices of multiple companies and embed them in standards. We were able to utilize that knowledge to create very effective standards that were practical but also appropriate for the global market place."

### His personal advice

When asked what advice he would give to a company that is not yet fully engaged in IEC work, Nosbush says: "My advice is to get engaged. I think your involvement is what makes it a better process. Your voice added to the input from numerous other businesses creates a better standard. It's that collaboration and the alignment of industry, of knowledgeable people and best practices that all of them bring to the table that creates a better global standard."



*Keith Nosbush, Chairman and President of Rockwell Automation*



# Centenary celebrations

IEC Netherlands National Committee reaches a hundred

**Another IEC NC (National Committee) has reached a major milestone in its electrotechnical activities. On 17 March 2011, after a 100 years of activity, it was the turn of NEC, the Netherlands IEC NC, to celebrate.**



*The tulip is a national symbol of the Netherlands*

The President of NEC, Frans Vreeswijk, greeted his visitors to the special ceremony held in the Haagse Diligentià, the old theatre in the Dutch city of The Hague, a place befitting such an occasion.

“And it is indeed a very special welcome in these hallowed halls of science and technology!” said Vreeswijk. “This beautiful theatre was once the seat of the practitioners of science, such as the Koninklijke Maatschappij voor Natuurkunde (The Royal Society of Physics), and engineering, and the Koninklijke Instituut van Ingenieurs (Royal Institute of Engineers). Both organizations resided in this building for many years.” It was, he said, also the birth place of the IEC NC.

Vreeswijk gave his guests a taste of the times, taking them on a brief journey into the past. “Diligentià – with an accent on the letter a – was the original name

of the Maatschappij voor Natuur- en Letterkunde (the Society for Natural and Literary Sciences), which was founded in 1793. The best translation of the name, Diligentià, is: ‘through diligence’ or ‘thoroughness’. The purpose of the society was to inform its members on the latest development in the natural sciences by means of lectures and demonstrations.”

The first NC meetings were held in the chairman’s own home because attendees were limited to 20. Later they moved to the Nieuwe Doelen (now the Haags Historisch Museum) and finally, when the society decided to buy its own premises, it bought the Diligentià and the adjacent coach house from the estate of the aristocratic Widow De Perponcher.

“The Koninklijke Instituut voor Ingenieurs, which was founded in 1847, was also based in this building, as was its

electrotechnical department,” said Vreeswijk. “It was here that the Board of Governors of the latter department made its plans to establish the Nederlands Elektrotechnisch Comité (Dutch Electrotechnical Committee) on 17 March 1911.”

He described how the term *electrotechnology* was first used in the 1880s to refer to light and electrical energy applications, even though electric light itself wasn’t born until the turn of the century.

## From electrical lighting to light on demand

“Nijmegen was the first Dutch city to implement electrical lighting,” said Vreeswijk. “Tilburg is today the first city in Europe to supply ‘Light on demand’ to a whole neighbourhood. The new kind of lighting is LED (light-emitting diode) street lighting, which will automatically burn



*Cone for outdoor LED lighting  
© Philips*

brighter when people pass by on foot or by bicycle, and automatically dims when no one is in the vicinity.”

**Consensus building is important for standardization**

Vreeswijk described some of the major traits of the Dutch people that have played a significant role in standardization. “Our country was the inventor of ‘polder model’ thinking”, he explained. “We are good at exchanging

knowledge and experience, and we have a great deal of experience in the field of consensus politics. Standards development is based on the same foundation of knowledge-sharing and consensus-building, and is therefore indispensable in the future.”

**The future of electricity**

If no one knows exactly what the future has in store, said Vreeswijk, it’s certain that communication, transport, work

and leisure-time are bound to take leaps forward. “Many of those developments will involve electricity, as in the case of energy generation, energy supply and energy conversion, LED (light-emitting diode) lighting, medical systems, the electrical vehicle, and the control of and communication between all those systems,” he said. “In other words, there’s a lot more to explore in the challenging future facing this 100-year-old organization!”



## About NEC

As a P-(Participating) Member of 121 IEC TCs (Technical Committees) and an O-(Observer) Member of a further 37 committees, the Netherlands NC is involved in 158 areas of IEC technical activities stemming from the most traditional such as rotating machinery, through

essential electricity generation, supply and distribution systems; switchgear, cables and fuses; luminaires, transportation and domestic appliances; and EMC (electromagnetic compatibility), high-voltage and renewable energies.

NEC holds the secretariat of three IEC TCs: TC 40: Capacitors and resistors for electronic equipment; TC 88: Wind turbines and CISPR/CIS/F: Interference relating to household appliances tools, lighting equipment and similar apparatus.

# Keep the engine running

Safety and performance of batteries certified by IECEE

**As EVs (electric vehicles) make their comeback – they were first seen in the 1900s and then briefly in the 1970s – much of the focus is on batteries, their main power source. Fuel-powered and hybrid cars, trucks, buses, locomotives and aircraft also rely on batteries to start their engine or, in some cases, the APU (auxiliary power unit).**

## Fuel-powered electric vehicles need batteries

Automotive batteries are rechargeable batteries that supply electric energy to automobiles, buses and trucks, powering the starter, the lights and the ignition system of a vehicle's engine.

Traction batteries are used as the main power source of EVs, be they cars, buses, locomotives and any other type of electric vehicle.

## Aircraft use batteries as well

Like car batteries, aircraft batteries serve to start the engines or the auxiliary power unit. But their role doesn't stop there. They are an essential component of the aircraft. In-flight electrical generation failure is an emergency that calls on the batteries to power the essential loads until landing and evacuation. They have even been used to restart the engines after the rare cases of engine flame-out. They also act as a buffer regulating the DC (direct current) network voltage, ensuring acceptable power quality for the equipment connected to it.

## Standardizing batteries

IEC TC (Technical Committee) 21: Secondary cells and batteries, is developing International Standards that deal with methods of tests and specific requirements for batteries used in fuel-

powered and electric vehicles as well as in aircraft.

IEC TC 69: Electric road vehicles and electric industrial trucks, is developing International Standards that cover wiring and connectors for traction batteries, rotating machines (traction and auxiliary motors) for EVs.

## Testing and certifying batteries

IECEE, the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components, is another essential player when it comes to certifying batteries. The IECEE CB Scheme, through its registered CBTLs (Certification Body Testing Laboratories), and NCBs (National Certification Bodies), can test and certify the batteries used in fuel-powered cars, EVs and aircraft against IEC International Standards, the IEC 61982 series in particular.

When testing and certifying EV batteries, IECEE focuses on multiple aspects. Electrical energy storage is an important element that will have an impact on EV range and battery-charging frequency. Endurance and lifespan are also under scrutiny.

To avoid risks such as overheating and short circuits, parameters such as voltage, current, power and temperature also need to be measured and tested.

## IECEE tackles hazardous substances

Many countries have passed, or are considering, legislation limiting the use of hazardous substances in electrical and electronic products, including batteries. Consequently, manufacturers are under great pressure to produce "clean" products in order to comply with said legislation.



IECEE tests and certifies batteries for aircraft - charging process shown here

The IECEE has started a CA (Conformity Assessment) programme for hazardous substances in response to manufacturers' need to offer products that meet hazardous-substance-free specific local, national and international requirements.

### List of IEC International Standards

Many IEC International Standards are used as a basis for testing and certifying all types of batteries. Among those, some are specific to automotive vehicles or aircraft:

#### IEC 60095-1

*Lead-acid starter batteries - Part 1: General requirements and methods of test*

#### IEC 60254-1

*Lead-acid traction batteries - Part 1: General requirements and methods of tests*

#### IEC 60254-2

*Lead-acid traction batteries - Part 2: Dimensions of cells and terminals and marking of polarity on cells*

#### IEC/TR 60783

*Wiring and connectors for electric road vehicles*



*IECEE tests and certifies also batteries for EVs...*

#### IEC/TR 60785

*Rotating machines for electric road vehicles*

#### IEC 60952-1

*Aircraft batteries - Part 1: General test requirements and performance levels*

#### IEC 60952-2

*Aircraft batteries - Part 2: Design and construction requirements*

#### IEC 60952-3

*Aircraft batteries - Part 3: Product specification and declaration of design and performance (DDP)*



*...and for fuel-powered vehicles for EVs...*

#### IEC 60982-1

*Secondary batteries for the propulsion of electric road vehicles - Part 1: Test parameters*

#### IEC 60982-2

*Secondary batteries for the propulsion of electric road vehicles - Part 2: Dynamic discharge performance test and dynamic endurance test*

#### IEC 60982-3

*Secondary batteries for the propulsion of electric road vehicles - Part 3: Performance and life testing (traffic compatible, urban use vehicles)*

## Fuelling safety

### IECEX Schemes help reduce risks

**Ex or explosive atmospheres are not restricted to oil refineries, offshore oil rigs, gas plants or mines. Many other industries also operate in potentially hazardous environments: sugar refineries, flour mills, grain silos and the paper and textile sectors, to name a few. Ex risks also exist in transportation.**

#### Ex areas near you

Unless you are driving an electric car, you are bound to enter a potentially hazardous area each time you need

to put petrol in your car. The most prevalent risks associated with petrol station environment hazards are fires and explosions.

Petrol is highly flammable, and can be very dangerous if proper safety precautions are not followed. There are several strict rules to be observed while refuelling, among them: Don't smoke. Don't leave the engine running. Touch the car body before refuelling to discharge static electricity. Watch for overflow.



*Strict rules also have to be observed at gas stations*



Strict regulations govern the personnel handling the refuelling...

**Aircraft refuelling: larger scale, higher risks**

Aviation fuel is generally of a higher quality than fuels used in less critical applications, such as heating or road transport, and often contains additives to reduce the risk of icing or explosion due to high temperatures, amongst other properties.

Aviation fuelling has a number of unique characteristics that must be accommodated. When flying, an aircraft can accumulate a charge of static electricity. If this is not dissipated before fuelling, an electric arc can occur which may ignite fuel vapours. To prevent this, aircraft are electrically bonded to the fuelling apparatus before fuelling begins and are not disconnected until fuelling is complete. Some regions require that the aircraft or fuel truck be grounded as well.

Aviation fuel can cause severe environmental damage, and all fuelling vehicles must carry equipment to control fuel spills. In addition, fire extinguishers must be present at any fuelling operation, and airport firefighting forces are specially trained and equipped to handle aviation fuel fires and spills.

Throughout the world, the strictest regulations are issued by airport authorities, airlines and oil companies to ensure that the storage and handling of fuel, the transportation of fuel by a tank truck

from the storage location to the aircraft, and the refuelling itself are performed according to the highest level safety.

**IECEX solutions**

IECEX, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres, has several solutions for manufacturers of equipment used in refuelling operations. The System has put in place a number of Schemes that provide assurance that equipment and systems are manufactured and operated according to the highest International Standards of safety.

**Proof of the right level of protection: IECEX Certified Equipment Scheme**

From the smallest to the largest piece of equipment used in refuelling operations, all can be tested and certified by IECEX. An IECEX Certificate is like a passport for manufacturers of Ex equipment. It provides clear proof of claimed compliance with International Standards. It certifies that the equipment in question has the right level of protection. It provides assurance that products bearing an IECEX Certificate conform to the International Standards listed on the same Certificate.

**Certified professional repair: IECEX Certified Service Facilities Scheme**

Because Ex equipment has a much higher capital cost than the same

equipment used elsewhere, repairing it is often more cost-effective than replacing it. This Scheme assesses and certifies that organizations and workshops that provide repair and overhaul services to the Ex industry do so respecting the strict requirements of IEC International Standard 60079-19, *Explosive atmospheres - Part 19: Equipment repair, overhaul and reclamation*. This ensures that unique Ex safety features are not compromised during the repair or overhaul process. The system includes on-site audits prior to issuing the IECEX Certificate and periodic audits to ensure that repair and overhaul processes continue to comply with requirements.

**Competency confirmed: IECEX Certification of Personnel Competencies Scheme**

The CoPC (Certificate of Personnel Competence) gives independent proof that the certificate holder has the required qualifications, experience and capability to apply the various Ex related Standards that cover tasks from Area Classification



...and aircraft refuelling operations

to installation, inspection, maintenance and repair covering equipment located in hazardous areas. All personnel working in an environment that uses fuel in high quantities qualify for seeking an IECEx CoPC.

To obtain a CoPC, a person submits an application to an approved IECEx CB (Certification Body). Regular re-assessment also ensures that the certified person

maintains these competencies. The certificate is personal, non-transmittable and valid across international borders.

In terms of the IECEx CoPC Scheme, competence is defined as “the ability to apply knowledge” rather than simply assessing knowledge. In this sense the assessments of persons include assessing their ability to perform certain Ex-related tasks.

Along with the other IECEx Certification Schemes, all IECEx CoPC Certificates are issued via the IECEx “On-Line” certificate System enabling full public view on the IECEx website at [www.iecex.com](http://www.iecex.com)

Find out more on the UNECE (UN Economic Commission for Europe) endorsement of IECEx in this issue of *e-tech*.

# United Nations endorses IEC

## New UNECE publication offers regulatory framework for Ex areas

**In January 2011 the United Nations, via UNECE (United Nations Economic Commission for Europe), recommended the IEC and IECEx, one of the three IEC Conformity Assessment Systems, as the world's best practice model for the verification of conformity to International Standards.**

UNECE recently published a “Common Regulatory Framework” that encompasses the use of IEC International Standards, with proof of compliance demonstrated by IECEx, the IEC's System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres.

The UNECE publication, *Common Regulatory Framework for Equipment*

*Used in Environments with an Explosive Atmosphere*, addresses the hazards in environments with a high risk of explosion such as mines, refineries, chemical plants and mills. It can be used by countries that lack regulation in this sector as a blueprint for their legislation, and also for aligning existing national regulations with internationally harmonized best practice.

### **International Ex certification facilitates access to markets**

“Ex-equipment” for use in such hazardous environments needs to be specially designed, installed, maintained and repaired to eliminate potential sparks and open flames. This heterogeneous sector plays an important part in many areas of economic activity and represents an important component of international trade.

This equipment undergoes severe testing and certification, which is very costly. Because differing legislation often does not allow countries to accept the testing and certification done in another country, manufacturers generally must have devices re-tested and re-certified whenever they want to enter a new market. For some companies, this investment simply may not be worthwhile for entering the smaller markets. Without certification, state-of-the-art equipment will remain unavailable, which means



*Explosive areas include pipelines...*

reduced safety levels both for local industry and for the populations that live around the sites that harbour potential explosion risks.

**Common language through IEC and IECEx**

Up until now, because of the lack of harmonized legislation for equipment for use in hazardous areas, countries that have not represented a sufficient market opportunity have been unable to access state-of-the-art equipment for use in explosive environments.

The UNECE common regulatory framework is based on and encompasses international best practice and International Standards, and in particular standards from IEC TC (Technical Committee) 31: Equipment for explosive atmospheres. It also formally endorses IECEx as the recommended global best practice model for verifying conformity to International Standards.

Uwe Klausmeyer of Germany, winner of the prestigious IEC Lord Kelvin Award for his exceptional work in the

field of standardization, said, “the UNECE framework regulation builds on the positive experience of multilateral schemes for assessing conformity to standards, such as the IECEx. Under these schemes, testing and certification are carried out through agreed procedures and by peer assessment. These systems are transparent, fully democratic and self-financing.”

**Mutual recognition – broad acceptance**

Members of the IECEx Certification System mutually recognize certificates and associated testing/assessment by other members of the System. Due to its broad global acceptance and recognition, this System helps eliminate duplicate testing and reduces assessment costs.

It also forms a clear basis for risk management and promotes free trade in Ex equipment and services, considerably reducing cost.

The System follows a “life cycle” approach, which covers installation, production, verification, inspection,



...and grain storage...



...and mines among others

maintenance and repair. It also provides a single international system to assess and certify the competence of personnel carrying out work or repairs in highly specialized industries where a risk of fire or explosion exists.

# High-tech travel

IECQ helps make electronic devices and systems safer

**The boom in air and road traffic in the past 40 years or so has been determinant in the development of electronics in those sectors. Today, all modes of transportation rely on electronics for navigation, communication or engine-control management as well as for entertainment. Electronic devices and systems are designed to bring more safety, reliability and comfort to pilots, drivers and passengers alike.**

**In the air...**

Avionics — a blend of aviation and electronics — comprises all electronic

systems for use on aircraft, satellites and spacecraft. It includes communications, navigation, flight and engine control, collision-avoidance and weather systems.

Avionics surfaced in the 1970s, pioneered by military aircraft development, and was soon adopted by civil airliners. The democratization of consumer flying in the second half of the 20<sup>th</sup> century and the emergence of low-cost airlines in the past decade mean increased air traffic, tighter airspaces and, consequently, the need for more sophisticated methods of controlling and ensuring aircraft and passenger safety.

**...on the road...**

Demand for automotive electronics has increased dramatically with the rapid



Car navigation system



Airbus A380 cockpit

development of the automobile industry worldwide. Integrated communication, navigation, entertainment and information displays are now part of even the smallest, cheapest cars.

### ...and on tracks

The pattern repeats itself in the railway sector. The emergence of high-speed rail was an accelerator in developing electronics control management, signalling and safety systems. The first ever high-speed rail commenced operation in 1964 in Japan, but it really took off in the 1980s with the French

TGV (Train à grande vitesse, or high-speed train) and equivalent European and Japanese trains.

As is the case in other sectors, the technology developed for the high-end segment found its way into regional, inter-city or commuter trains.

### High-quality electronics

To be able to rely on electronics for safety, reliability and performance, one needs to rely on what makes the electronic device or system work: the electronic component.

### Safety and reliability through IEC International Standards...

While quality is important in all electronics sectors, it is even more so in transportation. One tiny faulty component in a plane or train electronic system may endanger the lives of hundreds of passengers.

Several IEC TCs (Technical Committees) are involved in the development of International Standards

for the transportation sector, notably IEC TC 107: Process management for avionics, IEC TC 9: Electrical equipment and systems for railways, and IEC TC 69: Electric road vehicles and electric industrial trucks.

### ...and certification

IECQ, the IEC Quality Assessment System for Electronic Components, takes it one step further, testing and certifying electronic components for the widest possible variety of components. In addition, IECQ has a programme specifically designed for avionics, the IECQ ECMP (Electronic Component Management Plan) Scheme.

### Avionics certified

An ECMP is prepared by a manufacturer of aerospace electronic equipment in accordance with IEC/TS (Technical Specification) 62239, *Preparation of an Electronic Components Management Plan*. The International Standard describes the objectives to be accomplished by avionics manufacturers in managing electronic components in avionics systems.

The plan documents the avionics manufacturer's baseline processes to manage COTS (commercial, off-the-shelf) components. The processes documented in the plan satisfy high-level objectives, such as component selection, application, qualification, quality assurance, dependability, data management and obsolescence management. After the plan is approved as compliant to IEC TS 62239, the plan owner is authorized to manage all aspects of the COTS components, in accordance with the plan. All components used in the plan owner's products must satisfy the requirements of the approved plan.

The IECQ ECMP Scheme is now looking into developing similar certification for the automotive and railway sectors.

For more information on IECQ and the IECQ ECMP Scheme visit: [www.iecq.org](http://www.iecq.org)



Modern trains also rely heavily on electronics

# EVs key to sustainable individual transportation

Electrification is central to the future of transportation

**Worldwide concerns about diminishing oil supplies and rising oil prices, and the adverse environmental consequences of burning fossil fuels, are leading the quest for more sustainable transportation models in many countries. This applies in particular to the road transport sector, which is still almost entirely dependent on ICEs (internal combustion engines) and consumes more than half of the world's crude oil production.**

Transport overall uses 1 % of the electricity produced today, yet electric motors are more efficient than ICEs. They convert some 80 % of stored energy into powering a vehicle, against 15 % for ICEs; they also have a higher power-to-weight ratio and far fewer moving parts. Electrification of road transport is therefore an attractive solution to ensure sustainable transportation in the future. In this perspective EVs (electric vehicles) are set to play an important role.

## EV revival

EVs designed for personal transport were common early in the 20<sup>th</sup> century before being superseded by vehicles powered by ICEs burning petroleum-based fuels.

Personal EVs have been making a strong comeback under many forms since the turn of the 21<sup>st</sup> century. All global automobile manufacturers now offer a variety of EVs based on different technologies.

With the share of electrical and electronics systems in motor vehicles growing steadily over the years, the IEC's work is vitally important to the automobile industry. In addition to its IEC TC (Technical Committee) 69: Electric road vehicles and electric industrial trucks, other IEC TCs and SCs

(Subcommittee), such as IEC SC 23H: Industrial plugs and socket-outlets, are involved in the preparation of relevant International Standards. These apply to cables, connectors, relays, batteries, displays and countless other electrical and electronic devices and systems. The mass roll-out of EVs is set to expand the IEC's involvement in the automotive sector.

## EV expansion – a worldwide trend

The nature of car markets varies greatly throughout the world. Mature markets, such as those found in the US (United States), Europe, Japan and some other countries or regions where automobile ownership is very widespread, face significantly different issues from those found in fast-developing but still under-equipped countries such as China or India. Yet, there is a worldwide trend for a wider adoption of EVs.

The EU (European Union), for instance, aims at achieving an 80-95 % reduction of carbon dioxide emissions by 2050, compared to the 1990 level, in particular through the use of renewable sources of energy. The electrification of transport and substitution of oil as transport fuel are central to this decarbonization effort. Estimates on the future market share of EVs in the EU vary between 450 000 and 1 500 000 units by 2020-2025.

In his January 2011 State of the Union Address, US President Barack Obama called for a million EVs on American roads by 2015.

The Asia-Pacific region is another major area of future growth for EVs, with environmental concerns and oil prices key drivers for the electrification of transport. The sale of EVs in this region is expected to exceed 1.2 million units in 2015.

In Japan, METI (the Ministry of Economy, Trade and Industry) issued new goals for EVs domestic sales in April 2010. METI wants sales of these to account for 50 % of all new car sales by 2020.

In China, the 90 million or so cars on the roads at the end of 2010 accounted for 40 % of national oil consumption. With 15 to 25 million vehicles expected to be added every year between 2010 and 2020, China may have in excess of 200 million cars by 2020, "causing serious energy security and environmental issues", according to Wang Fuchang, director of China's Department of Equipment Industry. As a result, EV production is being strongly promoted as a cornerstone of China's 12<sup>th</sup> five-year plan (2011-2015). In



*Lohner-Porsche hybrid 1900, rebuilt in 2011*



*Prius PHEV (Plug-in Hybrid)*

September 2010, Beijing announced that it was providing 15 billion US dollars in seed money for the country's leading auto and battery companies to create an electric car industry. The sale of EVs in the country is projected to exceed 550 000 units in 2015.

Worldwide estimates vary, but EVs are expected to make up 5 % to 10 % of the global car market by 2020.

### Expanding offer

Confirmation of the expansion of the EV market globally and its economic potential has been given by the very substantial presence of new models from all the world's leading car manufacturers at recent international car shows.

At the March 2011 Geneva International Motor Show, where new models are frequently unveiled, vehicles presented by major manufacturers ranged from tiny urban two-seaters, to electric versions of current models or new designs of sedans, sports cars and small vans, and even an experimental all-electric Rolls Royce Phantom saloon.

EVs are currently available in a number of different configurations and powertrains:

- HEV (Hybrid Electric Vehicle), using a combination of an electric motor and ICE, with regenerative braking providing energy to charge the battery.
- PHEV (Plug-in Hybrid Electric Vehicle), using the same powertrain as HEVs, but with the possibility of charging the battery by plugging it to the electricity grid.
- REV (Range-extender Vehicle) another type of HEV, with propulsion from an electric motor, and charging of the battery by plugging it to the electricity grid or by an on-board ICE.
- BEV (Battery Electric Vehicle), all-electric propulsion only with charging of the battery from the electricity grid.
- HFCV (Hydrogen/Fuel Cell Vehicle), with electric propulsion only, the external energy being provided by an on-board hydrogen tank, a technology that is still at an early stage and not yet commercially available.

### Challenges

The mass roll-out of EVs faces a number of challenges mainly linked to cost, range and charging. But signs are that these obstacles will be gradually overcome in a not too distant future.

The price of EVs is still higher than that of similar ICE-powered vehicles, in particular for all-electric cars, with batteries representing the lion's share of the additional cost. New battery technologies and larger production volumes mean that the price of batteries will eventually come down.

Various schemes are under consideration or applied in many countries to encourage the purchase of EVs. These include government incentives and new business models. Government or local authorities in a number of countries offer tax rebates, one-off grants or subsidies for the purchase of EVs to offset the price difference with ICE-powered vehicles. Manufacturers, dealers or dedicated companies are offering leasing plans to encourage consumer adoption of EVs.

Range represents another factor limiting consumer adoption of all-electric vehicles. However, it is often essentially down to perception. So-called range anxiety on the part of drivers is not as severe as often reported, especially as many users drive relatively short distances, mainly to work. Yet the limited range of EVs is still seen by some as a drawback. Rapid charging and quick battery swap can help reduce the range limitations of current full-electric vehicles.

The EV charging infrastructure, still practically non-existent in many countries, can also be seen still as slowing the mass adoption of EVs. However, surveys of EV owners show that most find the range of plug-in EVs adequate and prefer charging these at home and avoiding public charging. Such findings were confirmed in Berlin, Germany, where the public charging network's chargers were largely unused by EV drivers.

### Opportunities

In the longer term, EVs are seen as having a significant role to play in the future smart electrification plans under development in many countries. Under such plans, plug-in EVs using two-way digital communications will be integrated in the Smart Grids that



*Porsche Panamera S Hybrid 2011*



Opel EN-V concept vehicle

are being developed in many countries to replace electricity networks that were built 50 or more years ago.

These EVs will help regulate the requirements of the electricity network. They can favour the integration of renewables like solar and wind energy by helping balance their intermittent supply.

**New business and policy models**

Electrification of individual transportation is vital for the future of transport in general and essential to cut dependence on

dwindling oil supplies and mitigate the adverse environmental consequences of burning fossil fuels. There are undoubtedly significant challenges, but solutions will be found to meet these.

Automotive industry experts agree that the appeal of EVs will grow as their range increases and their cost drops with improvements in battery and other technologies. These are domains where the IEC will play a central role. Innovative business and public policy models will also be needed to favour mass take-up of EVs.

# Curbing driver distraction

Over three quarters of road traffic accidents result from some kind of distraction. This can be cut.

**Driver distraction is not new; it is as old as driving. Driving is a complex task that requires constant attention and complex coordination between mind and body. International Standards should help reduce driver distraction.**

Drivers are confronted with four main types of distraction:

- Physical/Manual: Taking hands off the wheel to manually operate controls or devices, or to perform other tasks, such as eating, drinking or smoking.
- Visual: Taking the eyes off the road to look at something else, such as a screen or map. (Visual and physical distractions are often closely linked.)
- Auditory: Focusing on acoustic events not related to driving.
- Cognitive: Taking the mind off the road, being occupied by tasks not related to driving.

**Old problem, new distractions**

In recent years many so-called nomadic devices, such as personal entertainment

systems or mobile phones, have been brought into the vehicle environment for communication, entertainment or even as driving aids. If used while driving they may combine physical, visual, auditory and cognitive forms of distraction, in particular when they are not directly driving-related. They reduce situational awareness and raise the incidence of driver distraction.

Even some devices like satellite navigation systems designed to make driving easier are not always conceived or operated with sufficient care to prevent driver distraction.

Portable navigation devices, if designed and used properly, can have a positive impact as they allow drivers to pay more attention to surrounding traffic and reach their destination more directly.

**Fatal distraction**

The reasons for traffic accidents vary from country to country depending on a number of factors. But a study from the US (United States) NHTSA (National Highway Traffic Safety Administration) and the VTTI (Virginia Tech Transportation Institute) indicates that 80 % of crashes and 65 % of



"...and who's driving?", German road safety agency poster (2002)



Tablet steering wheel mount

near-crashes include some form of driver distraction.

Of the 5 474 people killed in accidents on US roads in 2009 because of driver distraction, at least 18 % involved reports of a mobile telephone as a contributing factor. The proportion of fatalities reportedly associated with driver distraction increased from 10 % in 2005 to 16 % between 2005 and 2009. Other countries with comparable car ownership patterns report similar findings.

Advanced mobile communication services pose an even more acute risk of driver distraction. Not just drivers but some companies are offering ways to use devices for which they were not intended by manufacturers, and which could lead to increased driver distraction. While the “iPad Steering Wheel Mount” might be great for when the vehicle is stationary, one might question its use when driving, even if it is described by its designer as “a great enhancement to safety”.

### International Standards to reduce driver distraction

It is estimated that some 40 % of a vehicle’s cost base is now accounted for by its electrical power and electronics control systems. This share is likely to increase further in coming years with the

general introduction of new technologies like ADAS (Advanced Driver Assistance System), which includes functions such as blind spot detection, adaptive cruise control, lane departure warning and automatic braking.

The IEC, through many of its TCs (Technical Committees), prepares International Standards for all electrical and electronic components and systems used in motor vehicles. These include not just cables, connectors and batteries, but also sensors, LEDs (light-emitting diode) and OLEDs (organic light-emitting diode) for displays, head-up displays and lighting, and new control systems, to name just a few.

Together with its two global sister organizations, ISO (International Organization for Standardization) and ITU (International Telecommunication Union), the IEC helps the automotive industry and equipment manufacturers reduce driver distraction with standards and design guidelines for ICT (Information and Communications Technologies) systems used in motor vehicles.

The importance attached by the three organizations to the driver distraction issue was highlighted by the “Managing driver distraction” technical session they

organized as part of their sixth Fully Networked Car workshop at the 2011 Geneva International Motor Show, 2-3 March in Geneva, Switzerland.

Speakers and participants at the session — who included key players in the development of technologies and standards and experts and executives from the car industry, the ICT community, R&D (research and development) institutes and other organizations — reviewed a number of new applications. Hands-free communication, speech-based services — speech prompts, audio and visual alerts, dialogue systems and communication services — superior sound quality and intelligibility, and telematics applications that may help reduce driver distraction if properly implemented were extensively discussed at the session.

### Responsible driving and use of technology

Technology has always played a significant role in improving road safety and reducing the number of accident-related fatalities. However, the fairly recent introduction in the driving environment of the new so-called nomadic devices, for communication, entertainment or even as driving aids, has resulted in a sharp increase in the incidence of driver distraction and associated deaths and injuries.

Driver distraction can and should be curbed. If International Standards have an important role to play in helping design and produce relevant systems and devices, the greatest advance in curbing driving distraction will be achieved through responsible driving and the sensible use of new technologies in the driving environment.



*Texting while driving is a major factor of driver distraction... and accidents*

# Electric vehicles: The first 50 years

## Early trials and triumphs

By Christian Manz

**As early as 1899, Nikolaus August Ott, inventor of the four-stroke liquid gas engine, was convinced that electric propulsion would eventually have its hour of glory. His forecast was ultimately confirmed this year. The automobile industry may be on the threshold of a new era 130 years after Gustave Trouvé built his tricycle...**

### First attempt

Initially, all actors were on an equal footing, whether they had chosen steam, gas, electricity or that foul-smelling liquid, petrol — sold only in chemist shops. All could rejoice at the bright prospects for automobiles. If Trouvé's 1881 tricycle still had pedals (one can never be careful enough...), its counterpart, unveiled a few months later by English engineers William Ayrtton and John Perry, didn't have any back-up propulsion system.

In 1893, Frenchman Charles Jeantaud established the first factory producing electric cars only. A real enthusiast, he took part in rallies and races where Count Chasseloup-Laubat and Emile Jenatzy were competing. The latter reached the incredible speed of 105.876 km/h on 1 May 1899 in his "Jamais Contente" electric car. This was the first time someone had driven an automobile over 100 km/h, "a diabolical speed that should be punished with thunder and lightning", commented priests and bishops. For their part doctors thought that eardrums would be ruptured by the noise of these "earthly rockets".

Even if none of these disasters actually happened, the pioneers, scared by this extraordinary performance, backed up. Endurance records replaced speed trials:

in 1899 it became possible to drive 140 km without recharging a car; one year later, it was 262 km, and in 1901 a French-produced Krieger managed 307 km.

In the US (United States), the Morris & Salom works renovated the New York taxi fleet with their silent and odourless Electrobat.

In Austria, Ferdinand Porsche was revolutionizing electric car production with his Lohner-Porsche Mixte Hybrid, which was the first-ever hybrid vehicle. It had wheel hub-mounted motors directly connected to the axle, making it possible to install electric motors on all wheels of a vehicle. Furthermore, this car could brake from all wheels: if required, one or several electric motors could be cut off to achieve the expected result.

At the turn of the century, several firms were offering all-electric private cars, delivery vans, lorries and buses. At the time, the French postal and telegraphic services and taxi drivers were strong

supporters of this technology. In 1898, the Automobile Club de France, which was also behind the first car show, launched a competition opened to all models of taxis. Participants had to drive 60 km every day over 12 days. All 16 electric vehicles that took part finished the competition successfully. The only petrol-engine car, a Panhard & Levassor, was disqualified, being too noisy and giving off a sickening stench.

Across the Atlantic Ocean, electric cars resisted bravely to the onslaught of the oil industry. Between 1907 and 1942 the Detroit Electric company was producing up to 1 000 vehicles a year. It was also in the US that, under pressure from George Baldwin Selden, a lawyer, the idea of imposing a punitive levy on all manufacturers of petrol engine cars was launched.

As early as 1879 Selden had registered a patent for a vehicle as a generic concept based on the so-called Brayton cycle engine (using a piston compressor to heat air, before mixing it with fuel and igniting



Emile Jenatzy reached 105.876 km/h in his "Jamais Contente" electric car in May 1899



Walker electric truck, US, 1920s

it in an expansion cylinder). In 1899 the Electric Vehicle Company decided to enter this flourishing market with the objective of establishing a monopoly on the production of taxis powered by batteries. In 1911 Henry Ford won a case by demonstrating that a car could not be powered by the Brayton engine, thus lifting one of the last remaining obstacles to the mass production of cars powered by petrol engines.

In spite of this, EVs (electric vehicles) were still very popular. There were around 35 000 of them in 1912. Vehicles were silent and very easy to drive; the electricity lobby had a powerful ally in the person of Thomas Edison.

However, the oil producers' camp had strong arguments: oil was cheap and abundant. Automobiles powered by petrol engines, which outperformed EVs in terms of range and speed, eventually took over the personal vehicles' market.

### Second try

The situation regarding commercial vehicles was completely different, with EVs ruling the roost in the 1920s. The sale of entire fleets of vehicles was



Peugeot VLV (Light City Car), 1942

a profitable business in particular as regards laundry vans or vehicles to deliver foodstuffs and drinks or newsprint.

Steinmetz, Ward and Walker were the US vehicle manufacturers of the time. In Germany, the main producers were Bergmann, Hansa-Lloyd and Maschinenfabrik Esslingen, which built vehicles with a maximum loading capacity of five tonnes. Germany's S&B and Hawa, as well as Automatic in the US, tried to launch electric micro cars on the market.

In Switzerland similar vehicles were built for the post office, in particular, by Tribelhorn.

However, if it proved fairly simple to charge the smaller vehicles, the larger ones needed special charging stations and there weren't many of these. France gradually lost its leading position as battery manufacturers refused to service their products. (Charging errors and poor maintenance considerably shortened the lives of batteries.)

On the other hand, in Germany, taxis and official vehicles could rely on a

professional network of charging stations. However, at the time there was no cross-border agreement for charging.

### Third attempt

Following the German occupation of France during the Second World War, a comprehensive ban was imposed on the sale of petrol. As a result many companies took a fresh look at electric propulsion and many different models were produced, from micro cars to eight-tonne lorries. With its VLV (Voiture Légère de Ville - Light City Car), Peugeot produced its first modern electric city car in 1942.

Spain had been suffering from a petrol shortage since the 1936-1939 civil war. Taxis, private cars and commercial vehicles were adapted to electric propulsion thanks to the local producers' skills.

In Italy, famous manufacturers like Lancia and Maserati had plans to build electric commercial vehicles.

### Fourth round

Fuel shortages continued after the war, allowing electric vehicles to remain attractive. However, their use was mainly limited to the commercial sector. Delivery men in particular valued this silent means of transport. In town electric vehicles could move around at any time during the day or at night.

The situation was much more complex for private cars. Buyers wanted fast and luxurious vehicles. Following "the greater, the better" principle, road cruisers soon started invading North American highways...

## Christian Manz

This is an edited and shortened version of an article by Christian Manz published in *Revue Automobile* (3 March 2011). Christian Manz writes on EVs, collects

and keeps documents on this topic. He can be contacted at: [vcmanz@gmail.com](mailto:vcmanz@gmail.com) *Revue Automobile* was the first European magazine dedicated to the automobile

industry. It was founded in 1906. <http://www.automobilrevue.ch>

# Power on the go

## The electric vehicle and its battery

**Focus by Boston Consulting Group, shortened and published with permission – full Focus available at: <http://www.bcg.com/documents/file36615.pdf>**

**The breakthrough for EVs (electric vehicles) will be directly dependent on technical advances for its key component, the battery. Today, all available automotive battery technologies have distinct advantages and disadvantages in terms of safety, performance, cost and other parameters. The specific energy of batteries – that is their capacity for storing energy per kilogram of weight – is still only 1 % of the specific energy of petrol. This limits the driving range of electric vehicles to some 250 to 300 kilometres between charges. Clearly, the quest to develop a more sustainable mode of transportation continues at high intensity. But what technological challenges will batteries need to overcome to meet fundamental market criteria? How far will be far enough? How much will their price need to come down?**

### Current technology

Lithium-ion batteries comprise a family of battery chemistries that employ various combinations of anode and cathode materials. Each combination has distinct advantages and disadvantages in terms of safety, performance, cost and other parameters. The most prominent technologies for automotive applications are NCA (lithium-nickel-cobalt-aluminium), NMC (lithium-nickel-manganese-cobalt), LMO (lithium-manganese spinel), LTO (lithium titanate) and LFP (lithium-iron phosphate). All automotive battery chemistries require elaborate monitoring, balancing and cooling systems to control

the chemical release of energy, prevent thermal runaway – a positive-feedback loop whereby chemical reactions triggered in the cell exacerbate heat release, potentially resulting in a fire – and ensure a reasonably long life span for the cells.

There is increasing interest and activity in exploring new technologies that might boost the specific energy and performance of future batteries. But while many universities and research laboratories are working intensely on this, most of these technologies are unlikely to be available for production on a significant scale before 2020.

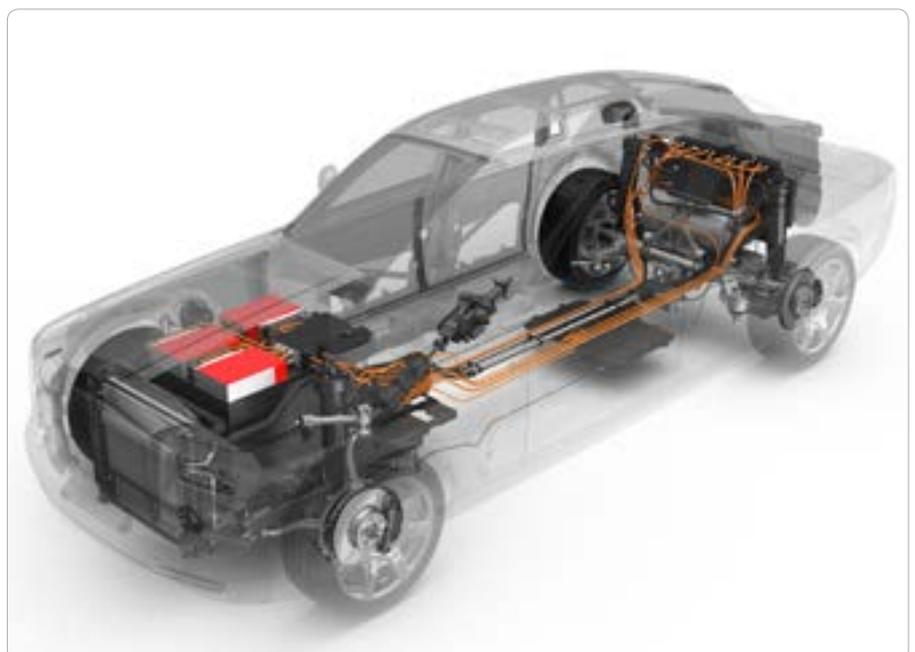
The recent explosion in innovation is driven by the need to break some fundamental compromises in battery technology. On the technical side, competing lithium-ion technologies can be compared along six dimensions: safety; life span (measured in terms

of both number of charge-and-discharge cycles and overall battery age); performance (peak power at low temperatures, state-of-charge measurement, and thermal management); specific energy (how much energy the battery can store per kilogram of weight); specific power (how much power the battery can store per kilogram of mass); and cost, which remains one of the major hurdles. Charge time, which does not vary substantially among existing battery technologies, remains a significant performance challenge.

Currently no single technology wins along all dimensions. A fairly high-performance solution such as NCA presents safety challenges, while LFP is safer at the cell level but provides a low specific energy.

### Safety

Safety seems to be one of the most important criterion for electric-car batteries. The main concern in this area



Rolls Royce EX 102 EV (batteries under bonnet)



Lotus supercharged range extender engine

is avoiding thermal runaway, which can be caused by an overcharged battery, too-high discharge rates, or a short circuit. Technologies that are prone to thermal runaway include NCA, NMC and LMO, and they must be used in conjunction with system-level safety measures that either contain the cells or monitor their behaviour. Such measures include a robust battery box, a very efficient cooling system (to prevent the early stages of thermal runaway), and precise state-of-charge monitoring and cell-discharge balancing.

While battery safety is indisputably a valid concern, it is useful to put this concern in context by recalling the significant safety challenges originally associated with the ICE (internal combustion engine) and with gasoline storage, which were largely overcome through improvements in design and engineering.

### Life span

There are two ways of measuring battery life span: cycle stability and overall age.

Cycle stability is the number of times a battery can be fully charged and discharged before being degraded to 80 % of its original capacity at full charge. Overall age is the number of years a battery can be expected to remain useful. Most automotive manufacturers are planning for a 10-year battery life span, including expected degradation. For example, an OEM (original equipment manufacturer) whose EV nominally requires a 12-kilowatt-hour (kWh) battery is likely to specify a 20-kWh battery instead, so that after 10 years and 40 % performance degradation the battery will still have sufficient energy capacity for normal operation. Of course, this approach increases the size, weight and cost of the battery.

Another option may be to install a smaller battery with a shorter life span and plan to replace it every five to seven years. This may allow OEMs to upgrade batteries as the technology continues to advance. Battery-leasing models, such as those proposed by Think, a manufacturer

of small city cars, and Better Place, a start-up provider of battery infrastructure, also allow for shorter-lived batteries. These models decouple the battery's life span from the vehicle's life span and remove up-front battery costs.

### Performance

The expectation that the owner of an EV should be able to drive it both at hot summer and sub-zero winter temperatures, poses substantial engineering challenges. It is difficult to engineer batteries that function over a wide range of temperatures without incurring performance degradations. One solution might be for OEMs to rate batteries for particular climates and rely on heating and insulation to make up for climate differences. However, climate-specific batteries would likely hinder mobility across regions and a lower performance may be preferable over the higher costs and other restrictions this would incur.

### Specific energy and specific power

The specific energy of batteries — their capacity for storing energy per kilogram of weight — is still only 1 % of the specific energy of petrol. Unless there is a major breakthrough, batteries will continue to limit the driving range of EVs to some 250 to 300 kilometres between charges. Battery cells today can reach nominal energy densities of 140 to 170 watt-hours per kilogram (Wh/kg), compared with 13 000 Wh/kg for gasoline. The specific energy of the resulting battery pack is typically 30 % to 40 % lower, or 80 Wh/kg to 120 Wh/kg. Even if that energy density were to double over the next 10 years, the range would hardly exceed 300 kilometres.

Specific Power — the amount of power that batteries can deliver per kilogram of mass — is relatively well addressed by current battery technologies. This is particularly important in hybrid vehicles, which discharge a small amount of energy quickly. In electric vehicles specific power is less important and equals or exceeds that of ICEs.

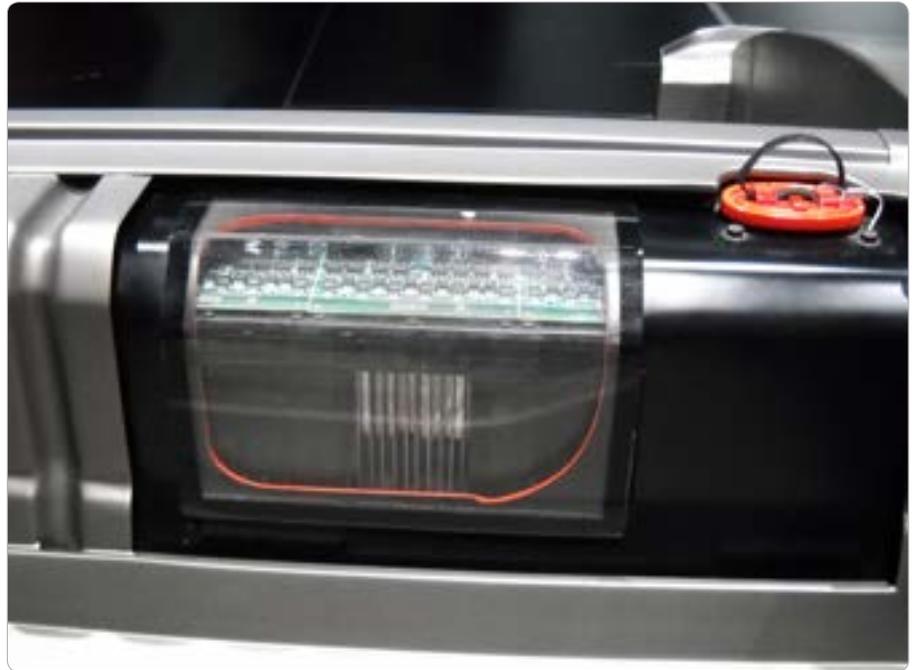
### Charging time

Long charging times present another technical challenge and a commercial barrier that must be addressed. It takes almost 10 hours to charge a 15 kWh battery by plugging it into a standard 120 Volt outlet. Charging by means of a 240 Volt outlet with increased power (40 Amps) can take two hours, while charging at a commercial three-phase charging station can take as little as 20 minutes. Battery-swap methods, such as the models contemplated by Better Place, promise to provide a full charge in less than three minutes. But such approaches need OEMs to agree to common standardization requirements.

Without a major breakthrough in battery technologies, fully EVs that can travel up to 500 kilometres are unlikely to be available for the mass market by 2020. Independently of the infrastructure that needs to be built both for charging or swapping batteries, adoption of such vehicles may initially be limited to commercial fleets and commuter cars that are confined to a certain range. Range-extender vehicles, which combine an electric power train with an ICE, can overcome the range and infrastructure limitations, but at an increased cost.

### Cost

The cost of the cell represents some 65 % of the battery pack. Battery costs will decline steeply as production volumes increase, but some 25 % of those costs — primarily linked to raw



*Cutaway showing lithium-ion cells in GM EV*

materials and parts — are likely to remain stable.

### Infrastructure

The cost for the charging infrastructure is another major component of EV expansion and operating costs. A large part of this will need to be financed by governments, power companies and private contractors. The infrastructure mix will depend on access to home charging stations, how far and where to people drive, and the use of range extenders.

Increasing electricity demand will also require upgrades to the grid, where

the IEC is directly involved in all key Smart Grid initiatives around the world.

### The future depends on standards

In the meantime, while engineers work on the possibility of increasing power and storage capabilities of batteries and possibilities for “instant” recharging technologies, it remains vitally important to continue working in a smart manner on standardizing the connectors and sizes of the existing batteries and EVs so that the future of personal transport can continue to progress in a clean and efficient manner.

## The Boston Consulting Group

The Boston Consulting Group (BCG) is a global management consulting firm and the world's leading advisor on business strategy.

BCG's wealth of knowledge covers the world's major industries and the most crucial business issues.

Founded in 1963, BCG is a private company with 67 offices in 39 countries. For full details see: <http://www.bcg.com/>

# How far will it go?

## Powering the electric vehicle

**A major challenge for the electric vehicle (EV) is its technical ability to store enough energy to reach its destination. How far is far enough? How can range anxiety be circumvented?**

When a conventional vehicle needs fuel, the driver stops at a service station, fills up and drives away. Being used to an infrastructure of service stations, he never really questions the range of his vehicle.

Charging an EV is a different story altogether. Most drivers don't consciously know how far they need to drive on an average day. Studies have shown that 80 % of drivers don't drive more than 80 kilometres each day. Despite that, consumers want their EVs to offer them a range similar to traditional automobiles.

Since public charging infrastructures for EVs are still in their infancy and battery performance and charging times also have issues (see article in this edition of *e-tech*), range anxiety could become a

major adoption hurdle in some countries. The same may not be true in public and commercial electrified transportation.

### Extending the range of BEVs

Speaking at the recent Geneva International Motor Show during the Fully Networked Car conference co-organized by the IEC, Pierre Malaterre of 4lcom talked about extending the range of BEVs (battery electric vehicles). "Although they are being improved constantly," he said, "the performance and cost of batteries remain the main obstacles to the widespread adoption of BEVs."

According to Malaterre, Lotus estimates that a battery-powered EV would need more than 127 kWh of battery capacity to achieve a range of 500 kilometres. This would translate into a weight of around 1 300 kg (the same as that of the base vehicle) and a cost of USD 76 000, based on USD 600/kWh.

In comparison, the REV (range extender for electric vehicle) unit that Lotus is developing weighs a mere 58 kg. Adding

more batteries to extend the range of EVs eventually becomes unproductive since at some point it is necessary to add more batteries to power the extra weight of the extra batteries that extend the range.

"One thing is certain, we are entering the era of the Electrical Vehicle. Some of our biggest problems are the behaviour of batteries, safety, performance, the charging process..." said Malaterre.

Underlining how various International Standards already exist for dealing with conductive charging systems, secondary batteries for the propulsion of EVs and plugs, socket-outlets and so on, Malaterre underlined the importance of the charging process itself.

"It is obvious that the charging process has to be standardized," he said. "Everyone must be able to recharge the battery of his car, anywhere and independently of what car brand he has. Different lobbies think that they have the right solution: electricity furnishers, service providers, electrical vehicle manufacturers.... Governments too want a universal infrastructure solution, and as soon as possible."

Malaterre believes that weight and cost constraints mean that HEVs (hybrid electric vehicles), PHEVs (plug-in hybrid vehicles) and REVs are likely to dominate the EV market for the foreseeable future.

### Heavier the more range

The Rolls Royce's Phantom EE (Experimental Electric) on display at the 2011 Geneva International Motor Show is reportedly able to travel about 200 km on a single charge that it obtains from a 338 Volt, 71 kWh unit. The battery comprises 96 induction-charged cells — said to be the biggest battery pack ever fitted to a car. The car's NCM (Lithium-Nickel-Cobalt-Manganese-Oxide)



Polishing up the Rolls Royce Phantom EE at the 2011 Geneva Motor Show

battery holds around 230 Wh/kg, a high-energy density necessary to provide an acceptable range between recharges. Delivered on an effortless wave of torque, it can reach 96 km/h (60mph) in under eight seconds (compared to 5.7 seconds in a standard Phantom), and has a top speed of 160km/h (100 mph).

### Contactless induction charging

Because of the concern about the lack of available recharging points in towns and cities and criticism of cables left trailing between power sources and vehicles, Rolls Royce has come up with what it sees as a potential convenience solution. The Phantom EE is testing contactless induction charging, which it feels will help provide a network of remote charging facilities.

“There are two main elements to induction charging: a transfer pad on the ground that delivers power from a mains source and an induction pad mounted under the car, beneath Phantom EE’s battery pack,” says a Rolls Royce spokesman. “Power frequencies are magnetically coupled across these power-transfer pads.”

### The same but in urban transport

Another company that has used this induction technology in an industrial context is Numexia. The Numexia prototype electric van is equipped with a contact-free energy-transfer system.

“With this technology, the vehicle batteries can be quickly recharged by electromagnetic induction, without having to resort to plugging in,” said Jean-Marie Van Appelghem, Chairman and CEO.

With a speed of up to 100 km/h (64 mph), the prototype can be run either in fully electric mode, or as a hybrid vehicle using an APU (auxiliary power unit), in this case an auxiliary 33 kw diesel engine that transforms thermal energy into electricity. The BMS (battery management system) uses four Li Fe PO (lithium iron phosphate) batteries. They can be fully charged in 30 minutes.



*The Serpentine, a project for driver-less public transport*

### Alternative driverless EV projects

The City of Lausanne in Switzerland has an automated driverless electric tram system that has been running since October 2008. On average, the tram transports 25 million passengers every year. Lausanne also developed an alternative transport project, the Serpentine which is basically an electric “taxi” service that runs without a driver along an underground magnetic rail that is imbedded beneath the surface of the road. The solution is cost-efficient both in terms of energy use and number of employees needed. In conventional public transport, the ratio of employees per 100 passengers is 4.25. Concerning the Serpentine, that ratio drops to 1.6. In terms of electricity, on average, the Serpentine was calculated to use only 251 W per day of use. In addition to supplying the vehicle with electricity to power the motor, the electricity also creates a magnetic field that guides the Serpentine along its path.

Vincent Bourquin, inventor of the Serpentine, believes that the automated low-speed EV is part of the future solution for urban public transport. “A vehicle need only travel at around 15 km/h in a city,” he says. “At that speed there is little danger to nearby people on foot, and if you equip vehicles with sensors then you can automatically detect the presence of others. With small electrified vehicles you can run a low-cost public service that is ecologically friendly, stops frequently and is quiet.”

### Induction charging EVs for cargo ships

Another area of commercial transportation that has expanded into electric motors is the port.

The logistics involved in container port management are huge. In recent years ports have become increasingly technical and adopted new automated portal systems to become more energy-efficient and to save space and time in loading and unloading cargo ships. One way is to use high-charge, short-life, contactless cranes that were previously powered with highly polluting diesel engines.

By installing automated unloading portal systems in 2005, the Belgian port of Anvers today, for example, is able to unload or reload 40 containers per hour against the Dutch port of Rotterdam’s 25.

With its partner TTS Port Equipment AB, Numexia has used the technology to develop a high-performance contactless AGV (automated guided vehicle) platform for loading and unloading container loads of up to 61 tonnes on harbour sides in ports.

The traditional diesel engines that are used to unload ships generate tremendous amounts of CO<sub>2</sub> (carbon dioxide). To displace the huge containers from or onto the ships requires several 150-200 horsepower engines, which, although they don’t have to move far, need a powerful acceleration for the short time they are actually in use. The rest of the time, the engines keep



Numexia's electric van

running and throwing out their column of black emissions.

Contactless energy-transfer technology, on the other hand, is far more energy-efficient. Using an underground power electronics element and coils, it supplies energy to the quay crane and stacking crane areas from underneath. There is also a vehicle-based system that uses the same technology in conjunction with super capacitors to store the energy that is used by the specially designed electric-wheel motors. Recharging energy takes only a few seconds. And, contrary to the Serpentine system, which transfers energy on an ongoing basis, the electric AGV uses a concentration of energy that is only transferred at key points, the remainder being stored in its supercapacitor.

## IEC International Standards

### IEC 61851-1

*Electric vehicle conductive charging system – Part 1: General requirements*

### IEC 61982

*Secondary batteries for the propulsion*

*of electric road vehicles - Part 1: Test parameters*

### IEC 62196-1

*Plugs, socket-outlets, vehicle couplers and vehicle inlets - Conductive charging of electric vehicles - Part 1: Charging of electric vehicles up to 250 A a.c. and 400 A d.c.*

### IEC 62660

*Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 2: Reliability and abuse testing*

## TC 69 Subcommittees and Working Groups

### WG 2

Motors and motor control systems

### WG 4

Power supplies and chargers

### Project Team 61851-23

Electric vehicle charging station

### Project Team 61851-24

Electric vehicles conductive charging

system - Part 24: Control communication protocol between off-board d.c. charger and electric vehicle

### Joint Working Group 69 Li

TC21/SC21A/TC69 - Lithium for automobile/automotive applications  
Managed by TC 21

### Joint Working Group 69 Pb-Ni

TC 21/SC 21A/TC 69 - Lead Acid and Nickel based systems for automobile/automotive applications  
Managed by TC 21

## Technical Committees

The IEC is directly involved in batteries for EVs through two of its TCs (Technical Committees), IEC TC 21: Secondary cells and batteries, and IEC TC 69: Electric road vehicles and electric industrial trucks.

# Power and water

## Alternatives to chemical batteries in transportation

**Fuel cells have the advantage of being non-polluting, non-combusting and producing no dangerous emissions, only water and heat. How close to broad-scale commercialization is this technology? What are the major opportunities and challenges?**

### Concentrated, highly efficient fuel

Fuel cells reach energy-efficiency levels of 40 % to 50 % in current road tests, compared to 15 % for ICE (Internal combustion engines).

Hydrogen is clean: it can be extracted from fossil fuels, a process that creates only a small amount of pollution, or made pollution-free with renewable fuels, in particular solar or wind. Filling stations that dispense hydrogen made with solar are already in operation on all continents.

Many car-makers have engaged in fuel cell projects, using fuel cells primarily to recharge lithium-ion batteries. But despite obvious advances – for individual transportation – fuel cell technology needs to still overcome a number of hurdles before it can reach broad-scale commercialization.

For one, since hydrogen is a very light gas, it is difficult to store a large amount in a small space. This is a challenge for automobile engineers, who need to match the 500-kilometre range of conventional automobiles, while keeping cost, vehicle weight and volume for hydrogen storage down.

### Urban transport

Urban bus systems are a logical application for fuel cells, largely because refuelling is concentrated at fleet depots. Buses can also store larger volumes of fuel than other vehicles. Government

support for the testing of hydrogen vehicles is significant. According to the London Hydrogen Partnership, annual investment by automotive companies and governments around the world in hydrogen vehicle technologies exceeds USD 3 billion. In the EU (European Union) hydrogen-fuelled busses already operate as part of public transport systems in 10 cities.

The Daimler Chrysler Citaro fuel cell bus, one of the makes used in the CUTE (Clean Urban Transport for Europe) project, has a range of 200 to 300 km, carries 60 to 70 passengers and is powered by a 250kW PEM (proton exchange membrane) fuel cell (200kW shaft power). It has up to 44 kg of compressed hydrogen gas stored at 350 bar.

London first trialled CUTE fuel cell buses between 2003 and 2007. On 26 January 2011 it introduced a fleet of eight hydrogen buses that link Tower

Gateway Docklands Light Railway station with Covent Garden. But the CUTE project is now global in scope with buses being trialled in 10 cities on three continents.

### Olympic Games and fuel cells

Major sporting events are increasingly being seen as an opportunity for governments to roll out infrastructure, with a view to encouraging manufacturers to commit to work towards volume manufacturing and associated cost reductions. Hydrogen and fuel cell transport has become a regular feature at the Olympic Games.

First in Turin, Italy, during the 2006 Winter Olympics, and then at the 2008 Summer Olympics in Beijing, China, where 20 fuel cell cars and three fuel cell buses were demonstrated.

The Canadian province of British Columbia used the 2010 Vancouver Winter Olympic and Paralympic games



London's fuel cell bus. Source: European Hydrogen Association

to roll out its "Hydrogen Highway": seven fuelling stations between Vancouver Airport and the resort town of Whistler. The world's largest single fuel cell fleet, some 20 buses, went into operation for the Canadian games. BC Transit's new Whistler Transit Centre, which includes the world's largest hydrogen-vehicle fuelling station, was officially opened at the games. Beijing already had a hydrogen refuelling station, with an on-site methane reforming facility, ahead of the 2008 games. Beijing had been selected, alongside Shanghai, by the GEF (Global Environment Facility) of the World Bank for the Fuel Cell Bus Demonstration Project. In 2007, an Anting hydrogen refuelling station was opened in Shanghai. Subsequently, at the 2010 Shanghai World Expo, 196 fuel cell vehicles, including six fuel cell buses, were deployed.

Beijing and Shanghai are both involved in the Chinese Government's 1,000+ Green Vehicles in each City' programme. The programme, which was launched in 13 Chinese cities, provides subsidies for the purchase of hybrid, electric and fuel cell vehicles. The American state of California is, unsurprisingly, home to a number of fuel

cell bus trials. The SunLine Transit Agency fleet in California uses UTC (United Technologies Company) Power fuel cells. And three AC Transit (Californian Alameda-Contra Costa Transit District) buses also run on UTC Power fuel cell systems.

Brazil, which will host both the 2014 FIFA (the International Federation of Association Football) World Cup and the 2016 Olympic Games, has invested significantly in fuel cell buses over the years and we can expect some on display during the forthcoming sporting events. A Brazilian hydrogen fuel cell prototype bus began operation in São Paulo in 2009 as part of the ônibus Brasileiro a Hidrogênio programme.

### Fuel cells in the air

Ground transportation may not be the only place where fuel cells could have an impact. PEMFC (polymer electrolyte membrane fuel cell) fuel cells were first tested in a commercial airplane in 2008. The test flight was carried out on an A320 aircraft owned by the DLR (Deutsches Zentrum für Luft- und Raumfahrt e.V., the German Aerospace

Centre). It was powered only by a fuel cell and lightweight batteries. The Fuel Cell Demonstrator Airplane, as it was called, used a PEM fuel cell/lithium-ion battery hybrid system to power an electric motor, which was coupled to a conventional propeller. During the test, the fuel cell system produced up to 20KW of electrical power. It powered the electric motor pump for the aircraft's back-up hydraulic circuit and controlled the spoilers, ailerons and elevator actuator.

"Currently fuel cell systems for commercial aviation are at an early stage of research and technology, and today it is not foreseeable that they would be used for commercial aircraft propulsion," says Airbus. "This requires a thousand times the electric energy that was produced during the test flight."

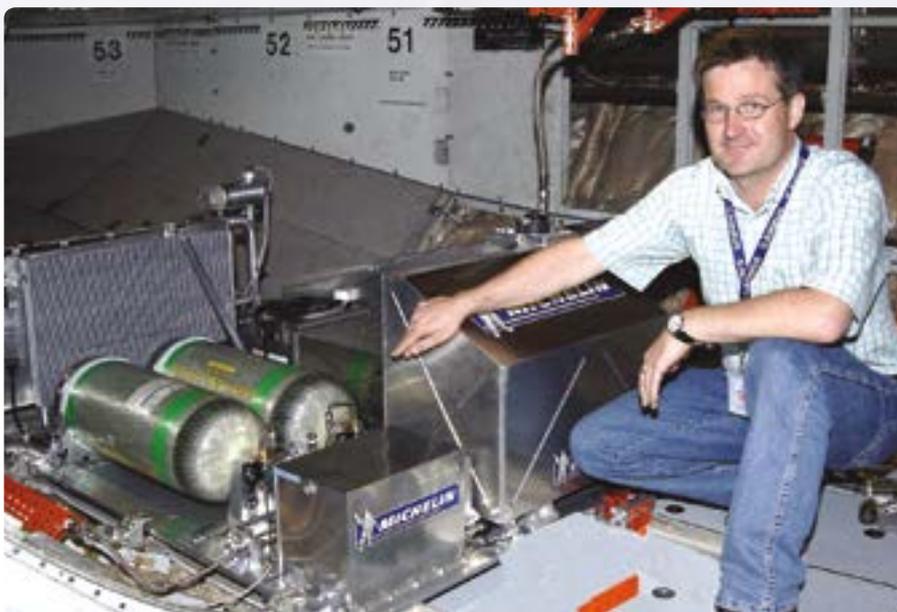
"To use fuel cells more extensively on board commercial aircraft, further improvements need to be made in terms of the amount of energy they produce versus their weight (ratio KW per kg)," Airbus says. Airbus believes that fuel cells could eventually replace the APU (Auxiliary Power Unit) that at present fuels aircraft functions such as starting up the main engine and the air conditioning, which would provide emission-free ground operations.

### Other uses of electricity for public transport

The March 2010 *e-tech* looked at the first use of fuel cells in trains in providing emergency power and changing the present infrastructure, but particularly as a replacement of the propulsion system of diesel locomotives to help reduce CO<sub>2</sub> (carbon dioxide) emissions.

### Technology challenges of fuel cells

Fuel cells could be the answer to many problems, but they also comprise some major challenges, some of which are particularly difficult to overcome and may represent a major hurdle for individual transportation systems. That explains



Fuel cell in Airbus - Credit: Airbus Deutschland.

why most progress seems to occur in public transportation systems. Challenges include cost, durability, size, weight, thermal and water management and infrastructure.

### Cost

Many components of fuel cells are expensive. For PEMFC systems, proton exchange membranes, precious metal catalysts (usually platinum), gas diffusion layers and bipolar plates make up 70 % of the cost. Many companies are working on techniques to reduce cost in a variety of ways, including reducing the amount of platinum needed in each individual cell. Experiments include catalysts enhanced with carbon silk, which allows a 30 % reduction (1 mg/cm<sup>2</sup> to 0.7 mg/cm<sup>2</sup>) in platinum usage without reduction in performance. Monash University in Melbourne, Australia, uses PEDOT, on Poly (3,4-ethylenedioxythiophene) as a cathode. A 2011 published study documented the first-ever metal free electro catalyst using relatively inexpensive doped carbon nanotubes that are less than 1 % the cost of platinum and are equal or superior in performance. While promising, all these technologies are still far from commercialization.

### Water and air management

In PEMFCs, the membrane must be hydrated, requiring water to be evaporated at precisely the same rate that it is produced. If water is evaporated too quickly, the membrane dries, resistance across it increases, and eventually it will crack, creating a gas "short circuit" where hydrogen and oxygen combine directly, generating heat that will damage the fuel cell. If the water is evaporated too slowly, the electrodes will flood, preventing the reactants from reaching the catalyst and stopping the reaction. Research focuses on methods to control the flow of water in the cells. Just as in a combustion engine, a steady ratio between the reactant and oxygen is necessary to keep the fuel cell operating efficiently.

### Temperature management and durability

The same temperature must be maintained throughout the cell in order to prevent its destruction. This is particularly challenging since a lot of heat is constantly generated as a direct result of the chemical reaction within the fuel cell.

Currently PEMFC membranes tend to degrade while fuel cells cycle on and off, particularly as operating temperatures rise. Since cars stop and start frequently, it is important for membranes to remain stable under cycling conditions. A particular challenge to durability is large differences in operating temperatures.

### Safety and delivery

A kilo of hydrogen has three times the energy of a kilo of gasoline, and because of its high energy content, hydrogen needs careful handling.

### Infrastructure

Last but not least, in order for PEMFC vehicles to become a viable alternative for consumers, a hydrogen generation and delivery infrastructure must be put in place.

### Fuel cells

The principle of the fuel cell was developed in 1839 by Sir William R. Grove. He discovered that hydrogen and oxygen could be combined to produce water and an electric current. It wasn't until 1932 that Francis T. Bacon produced the first successful fuel cell, a device using a hydrogen-oxygen cell with alkaline electrolytes and nickel electrodes. This was later used by NASA (the United States' National Aeronautics and Space Administration) to power Apollo and Gemini space explorations and produce drinking water for the crews. Today, fuel cell technology is used in cars, buses, office buildings and homes, phones and laptop computers and everything in between. Fuel cell systems can be extremely efficient over a large range of sizes (from 1 kW to hundreds of megawatts). Some systems can achieve overall efficiencies of 80 % or more when heat production is combined with power generation.

The differentiating element in the various sorts of fuel cells is the electrolyte, which is also what defines the operating temperature of the fuel cell. The solid oxide technology produces temperatures



*Fuel cell-powered Mercedes B-Class on the US leg of its 2011 world tour*



HyPM-16 fuel cell power

that can reach 800 degrees Celsius, which is fine for home use where the additional heat can be recycled and used in other ways, but not ideal for a moving vehicle. The best method for public transport and utility vehicles is the PEMFC (polymer electrolyte membrane fuel cell) technology that uses a permeable polymer membrane work to exchange protons at a temperature of around 80 degrees Celsius.

## About IEC TC 105

IEC TC (Technical Committee) 105: Fuel cell technologies, has already prepared a number of standards on safety, installation and performance of both stationary fuel cell systems and for transportation both for propulsion and as APUs. The TC has been very active since its first plenary meeting in 2000 in Frankfurt, Germany.

TC 105 Secretary Wolfgang Winkler is a mechanical engineer specializing in fuel cells system thermodynamics and system integration.

The market for fuel cells is expected to grow to an estimated USD 10 billion by 2020 with more than 90 % of that encompassing North America, the Asia-Pacific region and the European Union. The size reflects the demand and application for energy conversion systems, starting from micro devices and proceeding to farm equipment, cars, boats and trains to larger stationary systems.

Winkler says that International Standards can help to open the market by showing potential investors that groundwork

has already been well prepared and investigated, thus reducing risk to investors so they can indirectly mobilize capital.

The transportation sector is an interesting area for TC 105. Standardization in automotive applications is carried out jointly with ISO (International Organization for Standardization) TC 22/SC (Subcommittee) 21: Electrically propelled road vehicles.

Besides the automotive mass market, TC 105 is focusing on a number of other transportation applications.

Fuel cell standards are key for bicycles, construction machines, forklifts, leisure vehicles (e.g. boats, yachts, camping buses), medical applications (e.g. wheelchairs), mobile farming equipment, and a number of uses on board as APUs or for propulsion in aircraft, ships, trucks, rail systems and robots.

The fuel to be used can be a logistic one, standardized worldwide, or specific in special cartridges as hydrogen or methanol.

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

With good cooperation between battery and fuel cell, energy has to be supplied as the forklift raises its load and 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.

In cars the same principle is applied with different movements in two directions, for example up a hill and then down. "It's like a pendulum," explains Winkler. "During acceleration, or going uphill, energy of a battery is consumed. But during slowing down or going downhill the energy can be partially recovered and stored again in the battery. The fuel cell is needed to replace the energy losses caused mainly by friction."

# Nominations

## Officers of IEC Consultative and Technical Committees

In addition to its regular Technical Committees, the IEC has a number of Strategic Groups, Sector Boards and Technical Advisory Committees which report to the Standardization Management Board. This month, *e-tech* announces various changes and nominations.

### IEC TC 33

#### Power capacitors and their applications

SMB (Standardization Management Board) has announced the nomination of Esbjörn Eriksson to a third term as Chairman of IEC TC 33: Power capacitors and their applications. The new term runs from 1 May 2011 to 30 April 2014.

Capacitors (formerly known as condensers) are devices that store electric charge. The forms of practical capacitors vary widely, but all contain at least two conductors separated by a non-conductor.

The most important application of power capacitors is for power factor correction. In this application, the capacitors are connected in parallel or series to low-voltage or high-voltage networks.

Series power capacitors stabilize the transmission voltage, increase the transmitted power of the lines and control the power flow in parallel lines.



Other important applications for power capacitors are as couplers and dividers for capacitor voltage transformers, for a.c. (alternating current) motors, for microwave ovens and for induction heating and melting. Capacitors are widely used in electronic circuits for

blocking direct current while allowing alternating current to pass, in filter networks, for smoothing the output of power supplies, in the resonant circuits that tune radios to particular frequencies and for many other purposes.



### IEC TC 46

#### Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories

SMB has announced the nomination of Lauri Halme to a seventh term as Chairman of IEC TC 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories. The new term runs from 1 May 2011 to 30 April 2014.

The uses of waveguides for transmitting signals were known even before the term was coined. The phenomenon of sound waves guided through a taut wire have been known for a long time, as well as sound through a hollow pipe such as a cave

or medical stethoscope. Other uses of waveguides are in transmitting power between the components of a system such as radio, radar or optical devices. Waveguides are the fundamental principle of GWT (guided wave testing), one of the many methods of non-destructive evaluation.

Examples of waveguides:

- Optical fibres transmit light and signals for long distances and with a high signal rate.
- In a microwave oven a waveguide leads power from the magnetron where waves are formed to the cooking chamber.
- In radar, a waveguide leads waves to the antenna, where their impedance needs to be matched for efficient power transmission

Waveguides are used in scientific instruments to measure optical, acoustic and elastic properties of materials and objects. The waveguide can be put in contact with the specimen (as in a medical ultrasonography), in which case the waveguide ensures that the power of the testing wave is conserved, or the specimen may be put inside the waveguide (as in a dielectric constant

measurement[6]), so that smaller objects can be tested and the accuracy is better.

RF connectors are typically used with coaxial cables and are designed to maintain the shielding that the coaxial design offers.

Passivity is a property of engineering systems. It is used in a variety of engineering disciplines but is most commonly found in analogue electronics and control systems. A passive component, depending on field, may be either a component that consumes (but does not produce) energy (thermodynamic passivity), or a component that is incapable of power gain (incremental passivity).

A component that is not passive is called an active component. An electronic circuit consisting entirely of passive components is called a passive circuit (and has the same properties as a passive component). Used without qualifier, the term passive is ambiguous. Typically, analogue designers use this term to refer to incrementally passive components and systems, while control systems engineers will use this to refer to thermodynamically passive ones.



### IEC TC 79 Alarm and electronic security systems

SMB approved the nomination of Carlo Loi as Chairman of IEC TC 79: Alarm and electronic security systems, for the period 1 May 2011 to 30 April 2017.

IEC TC 79 prepares International Standards for the protection of buildings, persons, areas and properties against fraudulent actions aiming to enter in a place or to take or to use something without permission. The scope includes, but is not limited to, equipment and

systems, either used by ordinary persons or by trained people in the following residential and non-residential applications:

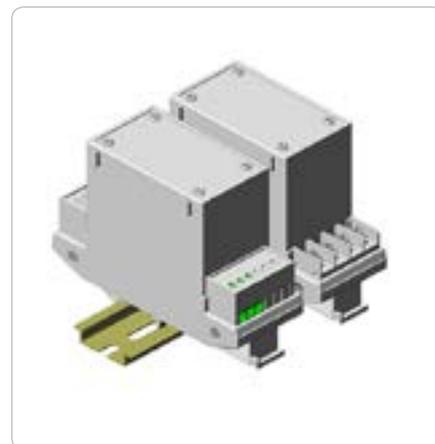
- Access control systems
- Alarm transmission systems
- Video surveillance systems
- Combined and/or integrated systems even including fire alarm systems
- Fire detection and fire alarm systems
- Intruder and hold-up alarm systems
- Remote receiving and/or surveillance centres
- Social alarm systems

## IEC TC 94

### All-or-nothing electrical relays

SMB approved the nomination of Christoph Oehler as Chairman of IEC TC 94: All-or-nothing electrical relays, for the period 1 March 2011 to 28 February 2017.

The main purpose of protection relay is to detect a problem during its initial stage, and to eliminate or significantly reduce damage to personnel and or equipment. Relays can identify problems by deviation in current, voltage, resistance or temperature. As the problem starts to develop severely, such as insulation breakdown, overheating or over voltage, the protective relay will interrupt power to the faulted equipment. Therefore, protection relay will isolate the faulted equipment and avoid the entire network to fail or cause more damages to personnel or equipment.



## IEC TC 97

### Electrical installations for lighting and beaconing of aerodromes

SMB approved the nomination of Siwert R. Wallman as Chairman of IEC TC 97: Electrical installations for lighting and beaconing of aerodromes, for the period 1 February 2011 to 31 January 2017.

TC 97 prepares International Standards for the design, installation, operation and maintenance of aeronautical ground lighting of aerodromes. The activity covers requirements that apply to the whole system from the incoming power to the aerodrome up to and including the luminaires used in aeronautical ground lighting.

## Sector Board 4

### Infrastructure of telecommunications networks

The SMB recently endorsed the nomination of Angelo Castellano, an expert in IEC TC 86: Optical fibres, as a member of SB 4: Infrastructure of Telecommunications Networks.

SBs (Sector Boards) also report to the SMB and are responsible for providing advice to the SMB on priorities and setting long-term strategy for standards in the sector concerned, looking at market relevance and developing a systems approach.

SBs may, like Technical Advisory Committees, set up ad hoc groups and develop guides and recommendations to the SMB and to TCs (Technical Committees) and SCs (Subcommittees) in the relevant segment. SB members are senior executives who are representatives of industry and users in a broad sense.



# Plug them in, move them on!

IEC work on International Standards for EV charging

**Electrification is essential for the long-term sustainability of individual transportation. Manufacturers are now offering a wide choice of EVs (electric vehicles). Some of these, plug-in EVs, require charging from the electrical grid.**

International Standards are essential to allow the successful global roll-out of such vehicles, consumer adoption and economies of scale for the automotive industry and utilities. The IEC is working on standards and on bringing stakeholders together to ensure that this happens.

## Fostering communication

There has been relatively little communication until now between the various stakeholders in the EV sector: automotive manufacturers, electric equipment suppliers and utilities. The IEC, and e8, a global organization of 10 world-leading electricity companies, brought these together at an international round table that took place in January 2011 in Washington DC, US (United States). This meeting represented a milestone for the future roll-out of these vehicles as all participants confirmed that the

IEC's existing and proposed International Standards for EV charging satisfied their global needs.

## International Standards for charging

As regards these International Standards, IEC TC (Technical Committee) 69: Electric road vehicles and electric industrial trucks, and IEC SC (Subcommittee) 23H: Industrial plugs and socket-outlets, have prepared and are working on a number of International Standards.

TC 69 has developed — among others — IEC 61851-1, *Electric vehicle conductive charging system*. This standard foresees four modes for the charging of EVs:

- Mode 1, AC (alternating current) — slow charging from a standard household-type socket-outlet.
- Mode 2, AC — slow charging from a standard household-type socket-outlet with an in-cable protection device.
- Mode 3, AC — slow or fast charging using a specific EV socket-outlet and plug with control and protection function permanently installed.
- Mode 4, DC (direct current) — fast charging using an external charger.

IEC SC 23H published IEC 62196-1, *Plugs, socket-outlets, vehicle couplers and vehicle inlets*, covering general requirements for EV connectors, and is currently close to finalizing IEC 62196-2 which standardizes the following elements needed for AC charging:

- Type 1 — single-phase vehicle coupler (vehicle connector and inlet), for example Yazaki or SAE J1772 (Japan, North America).
- Type 2 — single- and three-phase vehicle coupler and mains plug and socket-outlet without shutters, for example VDE-AR-E 2623-2-2.
- Type 3 — single- and three-phase vehicle coupler and mains plug and socket-outlet with shutters, for example SCAME plug developed by the EV Plug Alliance.

SC 23H is also developing IEC 62196-3 (DC) on requirements for the vehicle coupler. The work is still at an early stage and several proposals are on the table, including the DC quick charging CHAdeMO coupler, as well as the possibility to use the same vehicle inlet both for DC and AC charging.



Wall socket for EV charging



Plug-in Volvo car



Charging socket on Rolls Royce Phantom EX102 experimental EV

# Go East, Young Man!

IEC TC 9 50<sup>th</sup> meeting in China highlights growing importance of Asia in TC work

**In the electrotechnical domain, the importance industries or countries attach to a particular sector are good pointers to their actual participation in the work of IEC TCs (Technical Committees). The growing contribution of participants from the Asia-Pacific region in IEC TC 9: Electrical equipment and systems for railway, is a perfect example of this.**

The huge railway electrification plans in both China and Japan, and their extensive high-speed train programmes, reflect the weight both countries attach to modern electric railway transport.

## Narrow initial focus

The first meeting of what was then called the "Advisory Committee on Traction Motors", established in April 1924, was held in London, UK (United Kingdom) in July 1924. The scope of what was to become IEC TC 9 was originally limited to tramway motors, before being extended later to include railway motors.

IEC TC 9 now prepares International Standards that cover railway networks and metropolitan transport networks. These standards relate to systems, components and software and deal with electrical, electronic and mechanical aspects, the latter being limited to items depending on electrical factors.

The geographical span of this TC was also limited in the early years. Europe was overwhelmingly represented in what was to become TC 9: 15 out of the 19 participants in the first meeting came from Europe, three from the US (United States) and one only from Asia (Japan). Most of the meetings (nine out of 10) in the early years were held in Europe.

## Eastern expansion

If Japan was represented from the launch of this TC, China's participation in it is more recent.

China became an IEC member in 1957, and Chinese delegates attended a TC 9 meeting for the first time in 1963. Since then, Chinese involvement in TC 9 work has never abated, and three TC 9 plenary meetings have been held in China, including the 50<sup>th</sup> meeting.

Reflecting their involvement in train technology and in particular their high-speed train programmes, both China and Japan are among the top three most active members in terms of number of experts in TC 9 WG (Working Groups). They also lead a number of TC 9 PTs (Project Teams), WGs and *ad hoc* groups.

This greater involvement of two participants from the Asia-Pacific region in the work of a particular IEC TC is not unique; it reflects what is happening in other TCs and the growing participation of experts from all regions of the world in IEC work.

## IEC TC 9 meeting in China

The 50<sup>th</sup> meeting of IEC TC 9, was held in Changsha, China, on 26-28 October 2010. Apart from dealing with normal TC business and reviewing projects, the meeting offered a unique opportunity to look at what is now a more geographically balanced aspect of this TC, compared to its early years.

Delegates paid visits to the CSR Zhuzhou Electric Locomotive Research Institute Co. Ltd, in Zhuzhou and to the CRCC (China Railway Siyuan Survey and Design Group Co.) in Wuhan.

Charles Jacquemart, IEC Technical Officer from the IEC Central Office, gave

a presentation to CRCC engineers and officials on the IEC, its mission, structure and work. The objective of this extensive presentation was to familiarize CRCC engineers with standardization work and to encourage them to take an active part in it.

Delegates to the TC 9 meeting also had the opportunity of making a short trip between Changsha and Zhuzhou on a high-speed train that reaches speeds in excess of 320 km/h. China is currently building some 2 000 km of high-speed railway tracks every year.



Chinese high-speed train in Changsha station



Lineup of Japanese Shinkansen high-speed trains

# Updating Smart Grid methodology

Experts from industry, utilities and regional standards organizations from 13 countries attended an IEC international workshop

**An international workshop was organized in Paris, France, on 8-9 March by IEC TC (Technical Committee) 8: Systems aspects for electrical energy supply. The purpose was to debate Smart Grid use cases to build up requirements from existing practices.**



Substation



Turbine hall, Los Nihuiles, Argentina

A use case is the methodology used to identify, clarify and organize system requirements. Many requirements can be put together today from existing ones, thus avoiding unnecessary work. Use cases have a role to play in this process.

TC 8 Chairman Richard Schomberg notes that “the necessary new breed of standards on use cases is all about utilities’ needs”, a reason why major utilities such as the State Grid of China, Kepco (Korea), Tepco (Japan), Enel (Italy), EDF (France) and Wien Energie Stromnetz (Austria) attended the workshop.

Some 50 participants representing major industrial groups and utilities

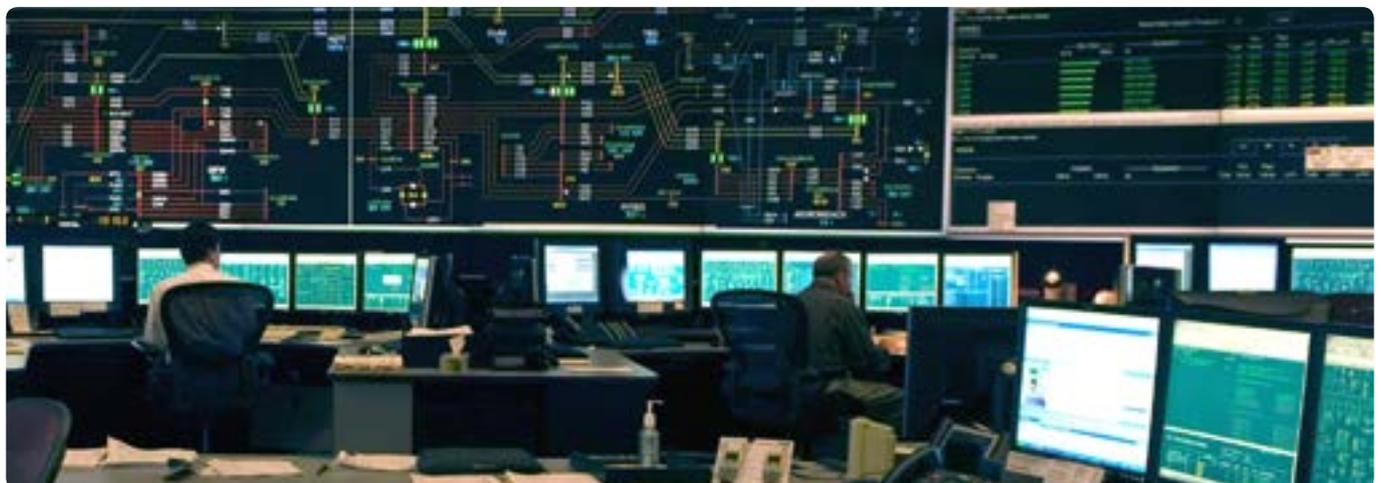
from 13 countries in Europe, Asia and the US (United States) took part in this workshop.

Four major regional and national standard organizations were also represented. They were: CEN, the European Committee for Standardization; CENELEC, the European Committee for Electrotechnical Standardization; ETSI (European Telecommunications Standards Institute) and NIST (the US National Institute of Standards and Technology).

TC 8 will provide the generic use case for all applications associated with electrical energy supply. It will start work shortly to:

- Update IEC PAS (Publicly Available Specification) 62559, *IntelliGrid methodology for developing requirements for energy systems*, with a view to publish it as a full International Standard.
- Select and publish limited series of generic use cases from the existing use cases (especially within the IEC). This work is to be carried out with all the IEC actors from different TCs.
- Define processes and organize a use cases repository.

The first working meeting will be held in Los Angeles, California, US, on 11-12 May 2011, following the invitation extended by Southern California Edison.



Control room

# EV propulsion

## Performance and reliability testing

**At the end of March 2011, the United States President Obama announced new energy security initiatives for making the US more independent of oil. In addition to expanding cleaner sources of electricity, his energy plan contained four major areas for development, one of which was for advanced vehicles.**

“Rising prices at the pump affect everybody – workers and farmers; truck drivers and restaurant owners” stated the White House fact sheet issued the previous day. In paving the way for the vehicles of the future, the US budget includes plans to put one million EVs (electric vehicles) on the road by 2015 providing redesigned tax credit for consumers, competitive grants for communities that encourage the adoption of electric vehicles, and funding for R&D to drive innovation in advanced battery technology.

Similarly, Beijing, never a major player in the internal combustion engine market, has ordered its auto industry to move forward in an effort to explore new areas. The Chinese government plans on taking a lead in the EV market with 5 million electric vehicles on the roads by 2020, roughly 35 % of the total world EV market according to HSBC. Present figures for the US and China combined show there are barely two million EVs on the roads.

### IEC TC responds to global energy moves towards the EV

Responding to global concerns about CO<sub>2</sub> reduction and energy security and the turn towards battery, hybrid and plug-in hybrid electric vehicles, one of the TCs (technical committees) of the IEC has already responded with two new International Standards on the high-power and high-energy density traction

batteries that will be necessary for the EV of the future to move forward.

### Performance and life testing

In December 2010, IEC TC (technical committee) 21: Secondary cells and batteries produced the first edition of IEC 62660-1 that specifies performance and life testing of secondary lithium-ion cells used for propulsion of electric vehicles, including both BEV (battery electric vehicles) and HEV (hybrid electric vehicles).

Lithium-ion batteries are expected to be one of the most promising secondary batteries for the propulsion of electric vehicles. This new publication provides a standard method for testing the performance requirements of lithium-ion batteries for automobile traction lithium-ion cells.

IEC 62660-1 was specifically produced to take into account the present global situation and the diversity of automobile battery packs and systems that exists, each with its own usage specificity. IEC 62660-1 provides test procedures that are sufficiently versatile to be able to obtain the essential characteristics of a range of lithium-ion cells for vehicle propulsion applications in terms of capacity, power density, energy density, storage life and cycle life. On the basis of IEC 62660-1 it will be possible to carry out basic performance and common primary tests of the lithium ion cells in a variety of battery systems and packs for vehicle propulsion applications.

### Reliability and abuse testing

The second part in this series of International Standards, IEC 62660-2, also published at the end of 2010, specifies the reliability and abuse testing for lithium-ion cells that are used for EV propulsion both in BEV and HEV. It

specifies test procedures and conditions for obtaining the data that is essential for the design of battery systems and packs including mechanical, thermal and electrical tests, charge, overcharge and discharge conditions.



First Chevrolet Volt



Lithium-ion battery pack in CalCars' EnergyCS/EDrive converted Prius.  
Source: Calcars.org



Nissan Leaf

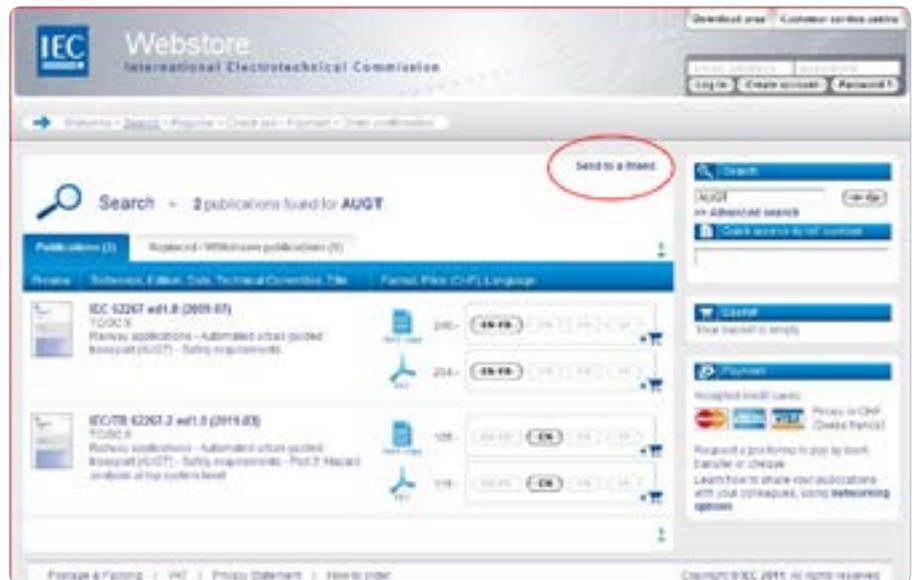
# Looks promising?

Send it to a friend

The IEC Webstore was the first part of the IEC website to take on the new look and fresh design. Now, a new “send to a friend” feature will help others discover the many facets of International Standards and the broad areas covered by the IEC and its publications.

You’re interested in transportation and you’ve just discovered the March 2011 IEC TR (Technical Report) 62267-2, *Railway applications - Automated urban guided transport (AUGT) - Safety requirements - Part 2: Hazard analysis at top system level*, published by IEC TC (Technical Committee) 9: Electrical equipment and systems for railways. You’d like to tell others about this new publication.

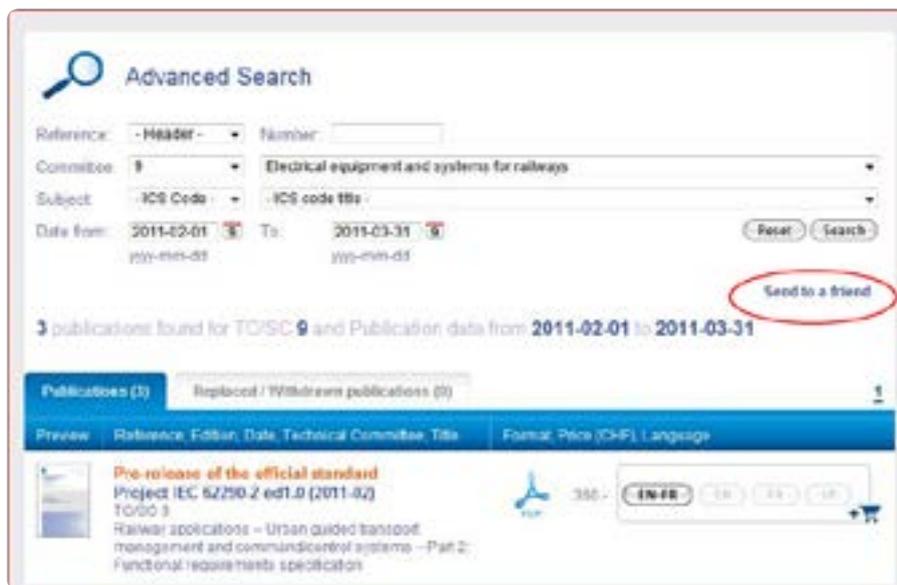
Now, with the *Send to a friend* button it’s easy to send a link of the publications you’ve listed and spread the knowledge about all the IEC publications available.



## Search or Advanced search



To use the feature you need to have your selected publications listed using either the Search or the Advanced Search boxes.



Enter a keyword(s) and press ENTER (or click Go) to display relevant IEC International Standards, or use the Advanced Search function to narrow your search and list publication(s) using different search criteria.

## Consult the preview

For practically any International Standard available online in the IEC Webstore you can consult a preview version that will allow you to view the entire list of contents and read other useful details about the scope and use of the International Standard.



## Mail to a friend

Once you've made your selection, click *Send to a friend* and fill in the relevant details, together with a short personal message.



# Website hints and tips

## From breadcrumbs to IEC NC pages

Last month's *e-tech* provided some essential keystrokes for accessing TC and SC dashboard pages directly. Here are some other hints and tips on finding your way around the new IEC website using the breadcrumbs and shortcuts.

### Breadcrumbs

The new IEC website uses breadcrumbs for fast navigation between pages in sections. Instead of having to use the Back key to follow your path to a previous page, simply click the relevant breadcrumb. Each hierarchical level is separated by the sign >.

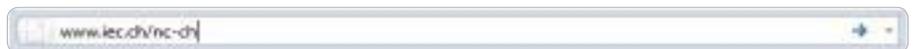


Point to and click *Technical Committees & Subcommittees* to navigate back two levels.

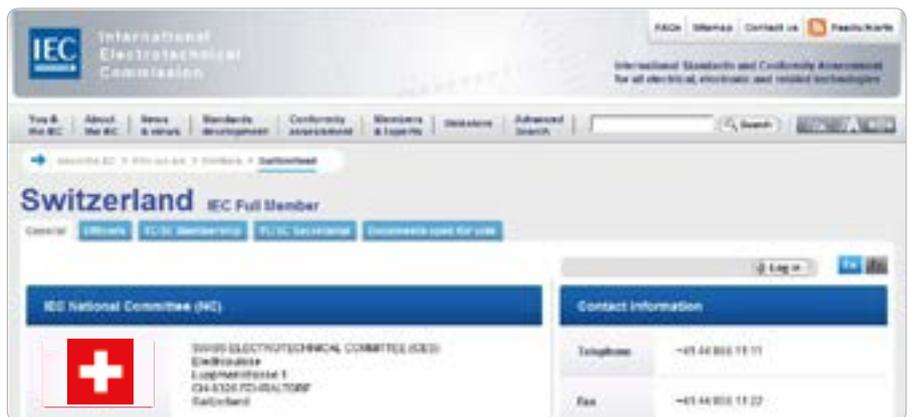


Click *e-tech* to reach the entry page for the current month's edition or *News & views* to reach the list of other recent news items.

### Navigate directly to a National Committee page



In the address bar of your browser window, type *www.iec.ch* followed by a slash (/), then the letters *nc*, a hyphen (-) and the two country initials. Your browser automatically completes the full address and displays the relevant page.





## Around the home

### Gardening, house improvement and security

An ever growing range of tools and equipment has moved from professional to domestic home use. Electric devices of all kinds have appeared in many households to help individuals carry out small repair or decorating work in the house, tackle gardening tasks or carry out car maintenance. The first industrial electric power drill was produced in 1916. Thirty years later a model aimed at the consumer market was launched and it was followed by a whole series of other electrically-powered tools for home use and later for gardening.

As the prices of these devices have declined, so they have become more accessible and easier and safer to use, to a large part due to the introduction of battery-operated cordless tools.

Homes have seen the addition of leisure features such as swimming pools, or systems that provide extra comfort and security, such as electric gates or garage doors, and various types of alarms systems or security lights. Renewable energies such as solar or wind may be used to power or heat some of these devices and systems in a not too distant future.

Issue 04/2011 of *e-tech* looks at some of the systems now in use around the house and the relevant IEC Technical Committees that are directly involved in developing International Standards for them to ensure they are safe to use, smart, energy-efficient and don't interfere with other equipment.





# e-tech

News & views from the IEC

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

If you would like to receive our monthly email notice telling you when the latest edition of *e-tech* is available, you can subscribe via the *e-tech* homepage. Click the button "Subscribe" or sign up for an RSS feed.

Articles may be reproduced in whole or in part provided that the source "IEC *e-tech*" is mentioned in full.

- Managing Editor *e-tech*: Philippa Martin-King  
- Editor in chief: Gabriela Ehrlich

Articles published in *e-tech* represent the opinion of their author and the IEC cannot be held responsible for content matter or content.

IEC *e-tech* is published 10 times a year in English by the International Electrotechnical Commission.

Copyright © IEC, Geneva, Switzerland. 2011.

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

3 rue de Varembé  
PO Box 131  
CH-1211 Geneva 20  
Switzerland

T 41 22919 02 11

Contact: [iecetech@iec.ch](mailto:iecetech@iec.ch)  
For more information visit: [www.iec.ch](http://www.iec.ch)

