e-tech

A selection of articles from the IEC magazine

Preparing the circular economy

Photo: emergencyrepairshop.com

Preparing the circular economy

As environmental concerns escalate, a new economic model which puts the emphasis on the recycling and reusing of materials and products is emerging. Electrical and electronic systems and products are particularly concerned, as they generate a high level of waste. E-waste is any refuse created by discarded electronic devices and components as well as substances involved in their manufacture and use. The IEC is working on many standards and publications which pave the way for an increasingly circular economy.

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This brochure contains a selection of articles from our magazine, *e-tech*, on IEC work for the circular economy.

From a line to a circle: a new shape for the economy

Using standards to help develop a circular economy

By Natalie Mouyal

A new mobile phone is released and millions of consumers purchase it even though they already own a working phone. A television set breaks down and is replaced by a new one, rather than being repaired. Based on a linear economic model, products are made, used and discarded.

Yet, in the long term, this economic model is unsustainable. The population of the world is expected to reach 9 billion by 2050, exacerbating the demand for scarce resources. Landfills are filling up rapidly, with municipal waste generation expected to reach 2,2 billion tonnes by 2025, compared with 1,3 billion tonnes in 2012, according to the World Bank.

A new economic model is emerging that re-evaluates our current approach to production and consumption. It calls for a paradigm shift across society in which products, components and materials are viewed as regenerative and restorative. An increasingly popular topic, the notion of a circular economy is gaining traction not only among environmentalists and academics but also within governmental and business sectors.

The IEC is examining the requirements for the circular economy. Exploratory studies are underway in the Advisory Committee on environmental aspects (ACEA), which provides guidance to the Standardization Management Board (SMB) on issues related to the environment, as well as in IEC Technical Committee 111, which develops horizontal standards related to environmental issues.

e-tech spoke with ACEA chair Solange Blaszkowski and with Kaisa-Reeta Koskinen, who leads the new ACEA task force on the circular economy, to gain a better understanding of this topic.

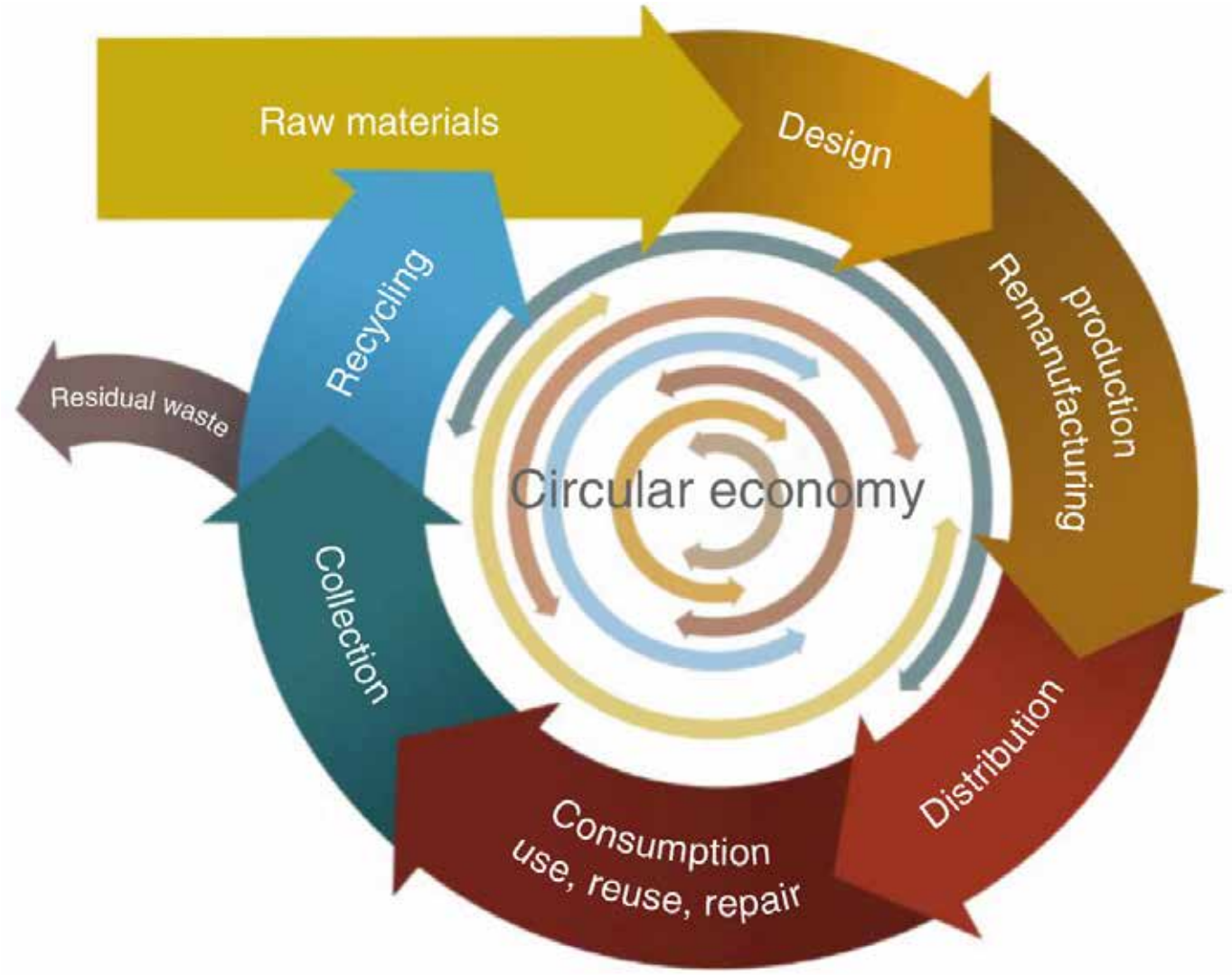
Solange Blaszkowski, Chair of ACEA

Defining a circular economy

According to Blaszkowski, the concept of a circular economy is a reconsideration of how resources are managed and how waste is perceived. It affects the entire lifecycle of a product, from initial design and the materials employed to the use of the product, its repair, reuse and the transformation of its parts into a new product.

> "We are talking about a system change."

Kaisa-Reeta Koskinen



New regenerative economic models are emerging

The Ellen MacArthur Foundation, a leading advocate of the circular economy, describes it as:

…a systemic approach to the design of processes, products/services and business models, enabling sustainable economic growth by managing resources more effectively as a result of making the flow of materials more circular and reducing and ultimately eliminating waste.

A circular economy is based on the effective functioning of existing (circular) mechanisms such as extending product lifetime, reuse, repair, refurbishment, remanufacture and recycling.

Koskinen gives the example of a mobile phone that is no longer needed. Instead of being discarded, it can be sold or given to a family member for their use. Should the phone break down, it can be repaired rather than replaced. Likewise, it can be upgraded to extend its functionality – for example by increasing its storage capacity. Eventually it can be resold or disassembled for the extraction of its parts, some of which will include secondary raw materials that can be recycled and used for other products.

However, the recycling of materials is viewed as a last option since only some of the materials are able to be recovered while others, especially those present in only small amounts, are lost. As Koskinen comments, “it is very easily misunderstood that a circular economy is about recycling. Giving another life to your mobile phone has more value than putting it in a recycling bin where only some materials can be recycled”.

Treating waste is currently viewed as a (negative) cost. In a circular economy, however, waste is instead viewed as an asset with inherent value. It is a resource that can be put to new use. Blaszkowski provides the examples of a digital imaging and printing company and a healthcare provider in the Netherlands which both include “asset recovery” as part of their business model. They strive

to keep their devices in operation for as long as possible and, when devices must be replaced, the useful parts in the original devices are given a second life in, for example, new devices or are reused as spare parts for other devices. To adopt this approach, these companies focus on ensuring that their products are robust and easy to repair rapidly – for example by screwing in parts rather than gluing them together.

The term material efficiency is often invoked when discussing the concept of a circular economy. However, according to Blaszkowski, "this term, often used in Europe, is generally misunderstood since only the properties of the materials themselves are considered". Instead, she notes, "we should think of material efficiency as the conservation of materials". It is about making products more durable, resource efficient and recyclable.

The circular economy should not be viewed as merely a means of maintaining consumption at current levels. It is different from resource efficiency which calls for the use of fewer resources to achieve the same outcome, but does not challenge the current linear economic model. Instead, Blaszkowski observes, "we need to change the mind-set of manufacturers and users and the whole system around it as well as the economies that support these systems".

Implications for manufacturers

Creating a circular economy will affect all participants in the product value chain: manufacturers and their business models, consumers and their behaviour and the waste management industry.

For manufacturers, the circular economy impacts products from the moment of their initial design. As Blaszkowski says, "you can have a product with a long life that is not repairable for e.g. safety reasons, or a product that lasts less, but is easily repairable. Trade-offs must be made based on product application". She lists a few examples that need to be considered, such as what type of materials – whether raw or secondary – to use, whether components can be reused, extending product usability by allowing upgrades to new technologies, improving the durability of the product and the ease with which it can be repaired as well as making it easy to retrieve certain materials when recycled.

Many hurdles exist with current business models. "Business models should stipulate making products that are as robust as possible, easy to refurbish or remanufacture or use components that can be retrieved and reused in new or reused products", says Blaszkowski.

> "We need to change the mindset of manufacturers and users."

Manufacturers may also be reluctant to reuse components or materials if quality is not assured. Some take-back schemes for unwanted products generally involve only those that have been produced by the original manufacturer since this affords the best traceability in terms of the quality of the materials used. And, because the recycling process varies between countries, the results will not be consistent.

Standards can be an important tool in promoting a circular economy. They can provide tools to measure aspects such as the durability or upgradeability of a product, the ease with which it can be repaired or recycled and ensure the quality of recycled materials. "Standards are needed for the entire supply chain", Blaszkowski comments.

Changing the consumer mind-set

Consumers will need to change current behaviours such as the continuous acquisition of the latest product models. New habits will need to be adopted such as the repair or upgrade of existing products, the use of second-hand goods and the adoption of product lease models. New services will need to be developed such as shops that can repair or refurbish products.

As Koskinen observes, "it will require a change from society as a whole and not only, for example, the economy". These changes will need to take place simultaneously across society. She remarks, "there is no point in manufacturers making products that can be repaired if consumers do not get them repaired, or if repair shops do not exist or the repairs are very expensive". Blaszkowski adds that there is little point in having manufacturers design products that are easy to recycle if a system is not in place to recycle the materials or able to guarantee the quality of its recyclates.

Education will be essential. As Blaszkowski comments, "it is always a question of education and the effort made to educate manufacturers and consumers to get them to learn new ways of thinking".

Waste not, want not!

Getting the measure of rising e-waste volumes

By Adrian Pennington

As the amount of electronic and electrical equipment waste (e-waste) generated each year continues to increase, the work accomplished by the IEC becomes ever more essential in helping manufacturers meet legal requirements.

Electronic waste is on the increase

The *Global e-waste monitor*, a joint report published by the United Nations University, the International Telecommunication Union (ITU) and the International Solid Waste Association (ISWA) estimates that in 2017 total e-waste output reached 44,7 million tonnes (mt). Only 20% of this waste was recycled through appropriate channels. By 2021, according to that same report, e-waste volumes are expected to skyrocket to 52,2 mt.

E-waste refers to any refuse created by discarded electronic devices and components as well as substances involved in their manufacture or use. Toxic substances such as lead, mercury, cadmium and brominated flame retardants (used in circuit boards, for instance) are employed in manufacturing these devices and components. If they are not properly recycled when discarded, these toxic substances can seep into the environment and may contaminate land, water and the air. When not recycled through standardized procedures, e-waste is buried underground in a landfill or burnt in an incinerator. Both will cause environmental pollution.

Global and regional action

Countries around the world have recognized the need for global action by signing different international agreements designed to regulate e-waste. They include *The Basel Convention* which aims to control transboundary movements of hazardous waste and its disposal and the *Minamata Convention on Mercury*, which sets target dates for the phasing out of products which may contain mercury, such as batteries, switches and compact fluorescent lamps.

Many other agreements or declarations of intent have been drawn up at national level. Several are based on the principle of extended producer responsibility (EPR) which encourages producers to manage the waste generated by their products that are out on the market.

In 2001, Japan started to adopt a new legal framework aimed at providing safer and more effective waste management, following the three Rs principle: reduce, reuse and recycle. Five industry-specific laws were adopted based on EPR. They include a home appliance recycling law (HARL), which concerns products such as air conditioners, refrigerators, television sets and washing machines. In Japan, EPR is compatible with a shared responsibility approach in which everyone bears the burden of waste management: citizens, businesses, municipalities and the national government. For example under HARL, retailers collect end-of-life

products, consumers pay the expenses mandated for recycling and transport and producers recycle the collected products. For producers, take-back is mandatory.

The system has helped to forge a culture of recycling in manufacturing plants. Examples include mass recycling of the rare earth metals used in the nickel-metal batteries for the hybrid cars produced by a leading automotive manufacturer.

In 2017, China adopted a new EPR plan which set targets for the e-waste recycling rate to reach 50% by 2025. The plan requires producers to adhere to environmental protection standards throughout the life of their products, rather than just focus on the manufacturing process. It will initially concern electronics, automobiles, lead acid batteries and packing products.

The latest e-waste legislation of the European Union is its 2012 directive on Waste Electrical and Electronic Equipment (WEEE). This was implemented by member states in 2014.

In developing countries, informal collection of e-waste is widespread. Backyard recycling, as it is sometimes called, can cause severe damage to the environment and human health. Crude techniques include open burning to extract metals, acid leaching for precious metals and unprotected melting of plastics. While a growing number of these countries are adopting e-waste legislation, the effectiveness of enforcement and even the type of e-waste collected and recycled varies considerably.

The need for international standards

Meeting the requirements of international standards is one of the ways to ensure electrical and electronic products comply with regional and international regulations on e-waste. The IEC is leading the way through the work of several IEC technical committees (TCs).

IEC TC 111 focuses on the overall environmental impact of electronic and electrical products throughout their whole lifecycle: from raw material acquisition to the manufacture, distribution, use, maintenance, re-use and recycling of their component parts. One of its key publications is IEC 62430, a horizontal standard which specifies the requirements for integrating environmental aspects into the design and development processes of electrical and electronic products. TC 111 is in close liaison with various IEC product-based TCs which deal autonomously with the environmental aspects relevant to their products. For instance, IEC TC 107: Process management for avionics, prepares standards which mitigate the use of tin and lead in avionics.

IECQ, the IEC Quality Assessment System for Electronic Components, launched the hazardous substances process management (HSPM) scheme which provides third-party certification for manufacturers who comply with the relevant national regulations in each country. IEC Advisory Committee on environmental aspects (ACEA), considers all the environmental protection aspects that relate to the detrimental effect of a product, group of products or a system using electrical technology, including electronics and telecommunications. It helps to coordinate IEC work on environmental issues to ensure consistency and avoid duplication in IEC International Standards. ACEA activities are focused on issues that relate to ecodesign and more specifically to substance management, end-of-life treatment and environmental labelling.

Urban mining under the spotlight

Rare earth elements are used in the production of electronic goods for which there is a growing or continuous demand. These include mobile phones, LED television sets, electric vehicles (EVs) and oxygen sensors.

An increasing number of companies and initiatives view cities as a “mine” from which rare earth materials can be reclaimed. According to the urban mining philosophy, materials are only temporarily used in buildings, industrial facilities, mobile phones or computers. After they have served their purpose, they can be recycled and reused in other products. Scrap material can be recovered from existing utilities, infrastructure and landfills to create a market in secondary raw materials worth EUR 55 bn, according to UN estimates.

Reusing materials carries the added advantage of being less polluting, as conventional mining for rare earths often involves high levels of toxicity. For example, a scheme developed at the University of British Columbia, in Canada, centres on a method of physically crushing and grinding discarded LED bulbs to extract metals including rare earths. Researchers on the project state that “from the LED itself, we can recover copper and small amounts of rare earth metals including lutetium, cerium, europium and the technology metals gallium and indium”. The researchers admit that “urban mining, even at its most efficient, can probably only meet about a quarter of the current demand for metals, but it can complement traditional mining and do the environment good at the same time”. In the long run, their aim is to limit the exposure of communities to potentially toxic materials and reach the elusive target of zero waste.

Managing hazardous substances

IECQ helps manufacturers and suppliers with their hazardous substance management processes

By Claire Marchand

Repairing electronic devices helps extend their lifecycle

Take a moment to think about the number of electronic devices you've acquired in your lifetime. Can you remember all the computers, tablets, phones, game consoles, cameras that passed through your hands at some point? Not to mention the electric toothbrushes, microwave ovens, hair dryers that you discarded because newer, smarter, more powerful models were launched and you thought you absolutely had to upgrade! Do you ever stop to think that all these devices that you enjoyed for a while only to be replaced by the next generation are your (small) contribution to the ever growing pile of electronic waste (e-waste)?

Growing demand for electronics = growing e-waste

In the past few decades, the demand for electrical and electronic devices and equipment of all kinds has skyrocketed, and so has the worldwide generation of e-waste.

The problem with discarding huge amounts of gadgetry lays not only with the metals and plastics they're made of that are dropped in landfills but also with the number of hazardous substances they contain, among them cadmium, lead and mercury. That in turn may have dire consequences for human health and for the environment.

What you can do as an individual

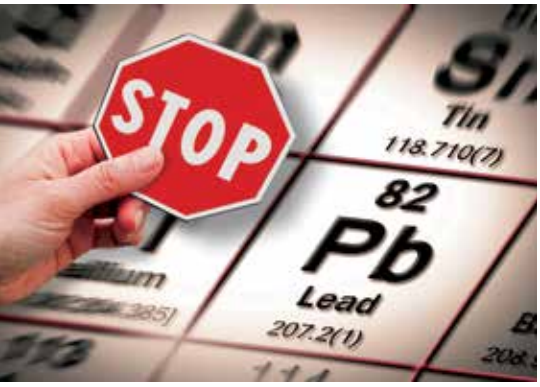
Getting rid of e-waste is most certainly a complete utopia. There are ways however to reduce the amount of e-waste.

As an individual there are some steps you can take. You alone may not make a difference but millions of individuals around the world might. Weigh the pros and cons of acquiring that extra gadget. Try finding multi-function devices. Prolong the life of your devices: protect them from shocks, don't overcharge them. Buy eco-friendly electronics. Don't throw away your devices when you get a new one but offer them to charities and social programmes. Have them repaired when possible, rather than discard them. And recycle electronics and batteries (many countries have recycling programmes in place).

Legislation in place

To address the issue of e-waste in general and hazardous substances in particular, many countries and regional bodies have put relevant legislation in place.

The European Union (EU) has two directives on restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) and on waste electrical and electronic equipment (WEEE). WEEE



Lead is one hazardous substances that is dangerous to humans and the enivronment alike

came into effect in February 2003 and RoHS in July 2006. Both directives have been revised since: RoHS in July 2011 and WEEE in July 2012. In view of a revision of RoHS, the EU Commission adopted, in January 2017, a legislative proposal to introduce adjustments in the scope of the directive.

Another EU directive on the registration, evaluation, authorization and restriction of chemicals (REACH), came into force in June 2007. It deals with chemicals and their safe use, so as to improve the protection of human health and the environment through better and earlier identification of the intrinsic properties of chemical substances.

EU countries are not the only ones to have drastically limited the use of hazardous substances. Many industrial countries around the world, including Australia, China, Norway, South Korea, Switzerland, Thailand and the United States, have followed suit and established their own legislation.

Programmes also exist that allow manufacturers and suppliers of the electronic components used in all modern devices to ensure that their products have extremely limited amounts of hazardous substances or are hazardous substance-free.

One in particular, set up by IECQ, the IEC Quality Assessment System for Electronic Components, has the perfect solution for manufacturers and suppliers who want to produce and distribute hazardous substance-free (HSF) electronic components: the IECQ hazardous substance process management (HSPM) scheme.

A truly global solution

IECQ HSPM is a technically based management systems approach to implementing and maintaining hazardous substance-free products and production processes. IECQ HSPM was developed in response to component manufacturers' need to give suppliers the means of demonstrating, through third-party assessment, that their electrical and electronic components and assemblies meet specific hazardous substance-free local, national and international requirements. Many companies today are working to attain IECQ HSPM Certification to IECQ QC 080000, *IEC Quality Assessment System for Electronic Components (IECQ System) – Hazardous Substance Process Management (HSPM) System Requirements*. The fourth edition, published in May 2017, clarifies how organizations can use IECQ QC 080000 to manage their hazardous substances other than through the outright removal of restricted substances and avoiding their use in products.

There are numerous advantages to using the 4th edition of IECQ QC 080000. Among them:

- → adaptation to global increasing hazardous substances legislation. For example, additional controlled substances, change control, product recall, as specified by the REACH regulation, the information communication within the supply chain, and notification to the European Chemical Agency (ECHA) about substances of very high concern (SVHC)
- → enhancement of documented information requirements in response to the applicable statutory and regulatory obligations. For example, requirements in the re-casted RoHS such as compliance assessment, preparation of technical file, preparation of self-declaration, use of markings, etc. can now be managed through IECQ QC 080000.

The new edition also aligns with ISO 9001:2015, *Quality management systems – Requirements*, and has adopted ISO Annex SL defining the new high-level structure for all ISO management systems standards.

The processes used to identify, control, quantify, and report the HS content in electrotechnical products, or their components, must be defined and understood in sufficient detail to assure all relevant interested parties of the HSF status of a product. The processes must be appropriately documented and conducted in a controlled and consistent manner to:

- → facilitate verification of compliance to applicable customer requirements and regulations
- → allow efficient and effective compliance checks
- → facilitate the consistent deployment across organizations and their supply chain
- → allow harmonization of compliance and enforcement methods.

The whole process helps reduce technical barriers for product trading worldwide.

IECQ QC 80000 is available on the IEC webstore in English, French, Korean, Russian, simplified Chinese and traditional Chinese.

For more information: www.iecq.org

How can IEC shape the circular economy?

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

By Natalie Mouyal

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

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

Defining the circular economy and material efficiency

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

According to the Chair of ACEA, Solange Blaszkowski, "the circular economy seeks to encourage the development and use of products that can last longer, be easily repaired and eventually remanufactured". But, as she notes, "it asks for a business model, reverse logistics and favourable societal and regulatory conditions. You can develop products that are easy to repair, refurbish or remanufacture, but you also need to have a business model in place on repair, refurbishment or remanufacturing. A reverse cycle is needed so that manufacturers can retrieve products for refurbishing or reuse their components to remanufacture new products. Users must also be willing to have their products repaired or buy a refurbished one".

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

Role of standards

Standards can serve as an important tool to promote the circular economy. They can, for example, provide methods to measure the durability or upgradeability of a product. They can assess the ease with which a product can be repaired or recycled. And, they can ensure the quality of the recycled materials.

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

Already, TC 111 has issued several publications related to the environmental impact of electric and electronic equipment. IEC 62430 specifies the requirements and procedures to

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

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

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

ACEA survey

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

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

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

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

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

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

TC 111 activities

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

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

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

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

Survey results on the circular economy and material efficiency

An interview with Solange Blaszkowski, Chair of IEC ACEA

By Natalie Mouyal

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

Solange Blaszkowski, Chair of ACEA

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

What was the purpose of the survey?

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

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

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

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

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

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

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

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

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

We also asked if any other topics not on this list should be included. We received some interesting input such as refurbishment, graphical symbols for product/service related to CE or ME, avionics equipment disposal and electroheating as a possible route for material recycling. This has given us answers in relation to recycling and material use.

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

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

We asked whether CE or ME aspects are already in standards and we can observe that the majority (67%) say no and do not have plans to include them. But those that responded yes are including topics such as upgradeability, reuse, end-of-life management and repairability in their standards.

What conclusions can you draw from the survey?

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

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

> "In the future, products will need to last much longer, will contain increased amounts of reused parts and will need to be repaired more often."

The survey shows that for many TCs/SCs/SyCs, the meaning of the terms CE and ME are not clear to them. For example, 35% of respondents did not find CE and ME to be relevant but half of them could identify relevant aspects from the list presented in the survey.

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

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

What are the next steps?

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

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

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

Protecting the planet

IEC TC 111 prepares crucial standards to help industry meet environmental targets

By Catherine Bischofberger

IEC Technical Committee 111 prepares horizontal international standards which are key in helping to ensure electrical and electronic products are designed with the environment in mind. They are essential tools in the fight against e-waste, while aiding manufacturers to meet legislative requirements on toxic substances control.

It is easy to only pay lip service to the protection and preservation of the environment. In this day and age, it is often more about marketing one's eco-friendly credentials than truly making a difference. But behind the scenes, a number of engineers, scientists and legislators are working hard to reduce environmental pollution in all sorts of areas. They include various members of IEC TC 111: Environmental standardization for electrical and electronic products and systems.

Paving the way for recycling and urban mining

Since its creation in 2004, the TC has published a number of crucial international standards relating to the environment. It is preparing for a future where recycling in a circular economy could well become the norm, while the recovery of rare earth metals – a process known as urban mining – may become widespread.

Before they can even begin to think of recycling the various materials they use in their goods, suppliers need to know and report the substances in their products so as to conform to the various pieces of legislation that exist across the globe. A key publication is IEC 62474 which establishes the requirements for reporting the substances and materials included in electronic and electrical products. It also facilitates the transfer and processing of this data by defining a common data format which applies to exchanges in the supply chain. The standard comes with a validated open database, which includes a list of substances, substance groups and common material classes. "We worked on an updated version of the standard which was published at the end of 2018. It is more flexible and has a wider reach than the previous edition, "The database now comprises lists of substances from industries which are not in the electrical sector", the Chair of IEC TC 111, Christophe Garnier, explains *(for more information on the new edition, read article on page 9)*.

Other major publications are the IEC 62321 family of standards, which defines standardized methods for determining the levels of potentially toxic substances in electrical and electronic products, by using various methods of measurement. "This important family of standards is prepared by Working Group (WG) 3. These publications cover ways of measuring several different substances. One of these is spectrometry, for instance. While WG 3 includes experts from different fields, we are looking for more test lab scientists to become involved", Garnier says.

Christophe Garnier, Chair of IEC TC 111

Eco-friendly design and joint work with ISO

The environmentally-conscious design of products has been a hot topic for many years. For instance, it is viewed as one of the ways of significantly reducing pollution by limiting the use of non-recyclable materials.

Yet another important standard issued by IEC TC 111 is IEC 62430 which provides guidelines for minimizing the adverse environmental impact of devices throughout their lifecycle. The publication defines environmentally-conscious design for all electrical and electronic products, for instance which materials are used, the quantity of energy consumed to make them, as well as their rate of recyclability. "We have formed a Joint Working Group with ISO, JWG ECD 62959, to prepare a global standard which will deal with the environmentally-conscious design of all products, not only electrical and electronic devices. This new standard will be published in a couple of years and should draw from IEC 62430 and the work of ISO/TC 207. It will bear the logos of both the IEC and ISO", Garnier reveals.

IEC TC 111 includes 25 participating member countries and 12 with observer status. "The most active countries are mainly based in the northern hemisphere. I would like to encourage all our members to take part in a proactive manner. Everyone can contribute – we must get more feedback from a higher number of developing nations as well, especially on environmental issues, as their input will be crucial as we move forward".

The TC held its plenary meeting during the IEC General Meeting in Busan at the end of October 2018. "We presented a study on the main initiatives launched around the world based on regenerative economic models. The outcome of this report was discussed during the plenary and a recommendation for a future standard relating to the circular economy was made".

The TC is studying different environmental labels

Another group is studying the different environmental labels around the world. "We are looking at the feasibility of harmonizing the criteria used in various recycling labels, for instance", Garnier explains. The work of IEC TC 111 might take place behind the scenes but it is more relevant than ever, as concerns about the environment reach new highs across the globe.

Form and substance

Increased flexibility and wider reach for key standard on substance reporting

By Catherine Bischofberger

A new edition of IEC 62474 makes chemical substance reporting easier for suppliers and manufacturers in the supply chain, helping them meet regulatory requirements.

Levels of hazardous substances in electrotechnical products need to be measured and reported (Photo: jble.af.mil)

Hazardous substances can be found in many products, including electrical and electronic devices and systems. As countries become more conscious of the negative impact of these substances on the environment, regulations have been adopted to enforce their reporting. Rulings also restrict the most polluting and dangerous chemicals. IEC publishes an international standard on substance reporting which improves transparency up and down the electronics supply chain. The publication also helps suppliers and manufacturers to comply with existing regulations. IEC Technical Committee 111, which specifies environmental standards for electrical and electronic products and systems, issued the first edition of IEC 62474 in 2012.

"The standard had a huge impact when it was published because it levelled the playing field. Before IEC 62474, the biggest suppliers could dictate their terms when it came to substance reporting. It also replaced existing national or regional standards, such as the *Joint Industry Guide* (JIG-101) and the *Japanese Green Procurement Survey Standardization Initiative* (JGPSSI)," explains Robert Friedman, Co-convenor of the IEC 62474 validation team.

New edition to meet user requests

IEC has issued a new edition of the standard which includes a number of improved features, in response to points raised by industry stakeholders. They wanted greater flexibility and ease of use when it came to substance reporting. Requests to widen the reach of the standard to sectors outside the electronics industry were also voiced. "One of the most important selling points of the second edition is that it is a one-stop shop, a very complete standard which provides information on what to report and how to report it, including a separate mechanism for the exchange of data down the supply chain," describes Friedman. The standard is also available in a red line version, highlighting the changes with the previous edition.

A common format is used to ease the transfer and processing of data. The standard also comes with a validated open database which includes a declarable substance list (DSL), which is updated in line with regulatory requirements. The new edition enables users to employ two different methods for declaring substances.

"The standard defines a declaration for compliance and a composition declaration. The first one enables suppliers to check their products against the existing DSL, whereas the second allows them to make a broader substance declaration, which includes, at a minimum, any declarable substances in the product. The composition declaration can optionally include other substances as well, and can even become a complete substance declaration. In the previous edition, the two different types of declaration were merged into one, with no clearly defined rules for substance reporting. This new approach makes things easier for both manufacturers and suppliers," explains Walter Jager, Co-convenor of the IEC 62474 validation team with Robert Friedman.

By providing both declaration methods, the new edition equally paves the way for likely regulatory changes. "Some companies are already willing to go beyond the declarable substance list and wish to report all the substances in their products. The composition declaration is, for the time being, mostly used for simpler products which do not include many substances to report. But looking towards to the future, companies will probably have to declare an increasing number of chemical substances in more complex products to meet new regulations concerning the environmentally-conscious design of products," Jager says.

All sorts of electrotechnical products contain chemical substances

Room for exemptions

The IEC 62474 DSL is regularly updated, as new or revised regulations are released. "It is brought up to date by three different groups dealing with separate geographical areas: Americas, Asia and Europe, Middle East and Africa (EMEA). These groups keep track of the various regulatory changes around the world," says Christophe Garnier, chair of IEC TC 111. A typical example of such regulations is the EU *Restriction of Hazardous Substances* (RoHS) Directive, which restricts the use of specific hazardous materials found in electrical and electronic products and which was most recently amended in 2017.

In the new edition of IEC 62474, exemption lists are included in the database. Restricted substances can be used in specific instances, when there is no other scientific alternative. "The use of exempted substances needs to be declared through the supply chain in a consistent manner. Downstream manufacturers want to be able to assess the compliance of their products and report exemptions when required. The new edition of IEC 62474 has harmonized a number of exemption lists that can be found in existing regulations, but as other exemption lists are identified, they can be added to the IEC 62474 database," explains Mark Frimann, Co-convenor of the Maintenance Team for IEC 62474, which developed the new edition of the standard.

"This means that countries wishing to replicate RoHS-type regulations could refer to the new edition of IEC 62474 in their legislation to specify exemptions instead of creating their own exemptions list. We do the work for them by always ensuring the list is up to date," Jager adds.

Reaching out to other industries

Another important selling point is that the standard can be used by any supply sector wishing to report chemical substances in their products. "The toy or the textile industry, to mention just a couple, could use the standard to meet their own requirements. It is easy to adapt it, all you need to do is establish the relevant list of substances in your product, using the IEC 62474 declaration methods and employ the exchange format for the transfer of data down the supply chain. The list of exemptions can also be customized," Garnier indicates.

According to Koshi Kamikagi, Co-convenor of the Maintenance Team for IEC 62474 with Mark Frimann, the new edition is a big step forward as "it can be used as a substance declaration in forward logistics, which involve all the processes required to get products to market, but also, just as importantly, as an information declaration standard linking forward logistics to reverse logistics, which relates to the reuse and recycling of products and materials."

Much further down the line, Jager envisages possibly working on a joint standard with ISO. "It makes a lot of sense to me. But there are quite a few issues to solve before we get there. One of them is making sure we keep the flexibility provided by the IEC 62474 database which is updated and validated on a regular basis," he concludes.

About the IEC

The IEC, headquartered in Geneva, Switzerland, is the world's leading publisher of international standards for electrical and electronic technologies. It is a global, independent, not-for-profit, membership organization (funded by membership fees and sales). The IEC includes 173 countries that represent 99% of world population and energy generation.

The IEC provides a worldwide, neutral and independent platform where 20 000 experts from the private and public sectors cooperate to develop state-of-the-art, globally relevant IEC International Standards. These form the basis for testing and certification, and support economic development, protecting people and the environment.

IEC work impacts around 20% of global trade (in value) and looks at aspects such as safety, interoperability, performance and other essential requirements for a vast range of technology areas, including energy, manufacturing, transportation, healthcare, homes, buildings or cities.

The IEC administers four conformity assessment systems and provides a standardized approach to the testing and certification of components, products, systems, as well as the competence of persons.

IEC work is essential for safety, quality and risk management. It helps make cities smarter, supports universal energy access and improves energy efficiency of devices and systems. It allows industry to consistently build better products, helps governments ensure long-term viability of infrastructure investments and reassures investors and insurers.

A global network of 173 countries that covers 99% of world population and electricity generation

Offers an affiliate country programme to encourage developing countries to get involved in the IEC free of charge

Develops international standards and runs four conformity assessment systems to verify that electrical and electronic products work safely and as they are intended to

IEC International Standards represent a global consensus of state-of-the-art know-how and expertise

A not-for-profit organization enabling global trade and universal electricity access

Key figures

173
members and affiliates

>200
technical committees

20 000
experts from industry, test and research labs, government, academia and consumer groups

>10 000
international standards published

4
global conformity assessment systems

>1 million
conformity assessment certificates issued

>100
years of expertise

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