IEC ACADEMY WEBINAR Q&A

Circular Economy and Material Efficiency - Principles, terminology and their influence on IEC standards, 14 Feb 2020

Questions	Answers
1. **You use the term "managing resources" in the definition of circular. Could you develop the theme of 'managing resources' by considering two perspectives?** **- exchanging one type of resource for another (e.g. exchange water for money)** **- using or consuming resources to make an effect which people enjoy (e.g. using water to enable life - agriculture, human and flood control etc.** **My recommendation is that some cross reference to EN12973:2020 could be very helpful**	Circular Economy (CE) has the objective to optimize the use of resources: it can use less resources, it can also replace one by another (e.g. that has less adverse impact for the environment or that is available in more abundance) or simply keep the resources in use as long as possible. I am not familiar with EN 12973:2020, but from what I read in the summary it could be interesting indeed. Perhaps this standard could be a theme for a webinar within CEN SABE (the equivalent of ACEA for IEC)?
2. **Slide 12 on material efficiency deals with my question - perhaps develop that slide on 'material efficiency' to recognise the concept of capital efficiency**	I googled for the term "**Capital efficiency**". This is what I found: **"Capital efficiency** is the ratio between dollar expenses incurred by a company and dollars that are spent to make a product or service. This can also be explained as the ROCE (Return on **Capital** Employed) or the ratio between EBIT (Earnings Before Interest and Tax) over **Capital** Employed." Material Efficiency focuses on the use of the materials only and does not take into account economic & environmental perspectives that are included in the Circular Economy. Circular Economy will be fundamental in allowing for decoupling of economic development from environmental degradation, while promoting health and well-being for all. So in my view, capital efficiency applies more to Circular Economy than Material Efficiency. When developing a product or service, the aspects like environmental and economic perspectives must be added, along with material efficiency.
3. **on slide 13: could there be strategies to grow natural resources - agriculture and nature dealing with diversity and strategies to increase the natural capital?**	In the pace the world is using and even depleting natural resources (for example by destroying natural resources like forests to use the ground for agriculture!), we should better think of "Regenerating natural systems and resources". Biodiversity goes along with the regeneration of natural systems. Although this is not of direct relevance to IEC, researchers point out that planting trees in high numbers would be a way to restore natural resources, and to control climate change.
4. **Slide 13. Why is recovery put in the waste phase? When you recover and use parts again than this is no waste?**	In this slide, recovery refers to, in particular, energy. Reuse of product and components happens still in the use phase (the end-of-life of a product that is then returned to the manufacturer for parts harvesting and refurbishment or remanufacturing). In most sectors and countries when products reach the waste phase they will be either recycled or energy recovered (or go to landfill).

	There is however one exception: waste electric and electronic equipment (WEEE) in Europe. EU included in the legislation that WEEE can be reclaimed from the waste stream and be “prepared for reuse”. Meaning “waste” products and parts can be put back on the market as REEE (Reused Electric and Electronic Equipment). *NOTE: during the webinar we promised to review slide 13 to clarify this point, but thinking better, it will add too much complexity to the already complex figure, so we prefer to maintain it as is.*
5. On slide 15 - looking at material efficiency across the whole value stream is helpful - It's not just the material incorporated within the product - Its other things like fuel for worker to get to work	Agree. That is why we need to look from the whole perspective by including environmental assessment (see slide 16) in the complete picture. The efficient use of materials in a product cannot be seen separately from the rest.
6. (A) What are your thoughts about the reliability of reusing used components? Is there not a high risk that products will fail more frequently and put the consumer off from using repaired products? This also could increase the liability obligation on the repairer making it uneconomic or more expensive. **(B) How do Standards address the IPR issues relating to FW/SW upgrades, in some products these are not offered free of charge because of the IP investment?**	(A) - Reusing used components is dependent on the type of the component as well as the ability to assess the condition of the component. Assessing reliability of parts is key to allow for safe and good performance of reuse of parts. Today, safety assessment by means of “hazard-based safety risk assessment” is used to predict how the product can be “foreseeably” used in practice. This type of assessment methods will need to be extended to other important functions of the product, like performance, EMC, etc. Not an easy task, but a needed one. Important is that IEC standards should be able to offer some direction to manufacturers on how to reuse parts, no losing from the sight the economic viability. (B) - This question has to do with the fact that in the future products are expected to live longer, and with it, availability of FW/SW updates are likely to need to be offered for more extended periods of time. This issue is likely to be addressed in legislation, setting minimum periods of time for availability of SW/FW updates. IEC standards normally do not cover aspects like IP. Where those are used commercially, the above trend is not like to change it.
7. How will it be possible to "sell" the idea of buying a new product that contains recycled parts? When I buy a new car, I do not expect an old dynamo in it or an already used engine.	Today products containing used parts are normally sold as e.g. refurbished products. However, new products do contain already reuses (recycled) materials, and this seem to be linked to a positive experience. I expect that in the future, consumers will need to be educated on this perspective. As issues like climate change and the need for environmental protection become more and more embedded in the communal subconscious, buying behaviour is likely to change. Also legislation will play an important role in getting acceptance, but also setting acceptable definitions in place, like how much % of reuse parts may a product contain to still be considered a new product. On the other hand, as the business models change towards a shared economy (share/lease/rent/etc.), probably this discussion will not even be relevant in the future.
8. Why will sharing and lease drive the development of products that last longer?	Because as the manufacturers will own the products, and they will get them back and can use the same product for the next lease phase (and the next, and the next…). As such, they can use premium, more expensive, materials and technologies that are known to extend the life of the product and allow for as many use cycles as possible. In order to run a sharing/leasing business in an economic way, products need to be designed in a way that they last for a long time. This might include a high durability and/or an easy way to repair/upgrade these products. It boils down to the simple relation: the longer a product lasts, the higher to potential profit achievable.

9. Referring to slide 16, are there clear rules on how to deal with the multiple trade-offs between material efficiency and other criteria? Example: in electrical applications higher efficiency usually means using more conductor material (in cables, motors, transformers...). Up to which point we can use more material to save energy?	Currently, there are no clear rules on how to balance trade-offs. This is future work. In general some "concessions" can be expected towards saving materials or using them longer over saving energy, taking into account that we also use materials to produce energy! This means that focussing only on the product does not provide information with actual used by the whole system. A possibility to balance different energy/material efficiency aspects would be to minimise environmental impact via LCA (life cycle assessments) of different design options. However, today LCA's do not embed the aspect "time" (e.g. durability), and therefore are not able to give balance answer. For example, by using more material, a worse LCA outcome is obtained. However, if using more material would improve the durability of the product, allowing for the product to stay in use much longer, this may compensate the initial (less good) LCA result.
10. You were saying LCA is not enough to measure Circular impacts. In fact is related to environmental calculations. At this point, are there other methodologies or standards that could be tackling better these issues to develop a systemic approach to start applying CE principals on products or processes design?	One of the shortcomings of LCA is the aspect "time" (see also question 11). This is currently a big discussion within the building sector. If for example more, or special materials are used to build e.g. a bridge, the LCA will become worse. Even if the lifetime of the bridge was double (from 50 to 100 years). Another issue is how to do the trade-offs. Normally a LCA is applied to a product. However, a product with worse LCA may have a much better behaviour within the whole system. Today ECD (Environmental Conscious Design) is normally applied at product level (server), and not system (server plus cable and WiFi infrastructures like local modems, transmission towers, etc.).
11. Have you already identified conflict between standards on safety or other aspects that clashes with circular economy requirements?	Yes, we do have such cases. Taking power cables as an example: today IEC safety standards on household appliances require that products are delivered including power cables. The idea behind is that if consumers use only the supplied cables, there will not be safety issues. This leads to a proliferation of the number of cables, and therefore, a huge amount of electronic waste. This is exactly what the circular economy has the objective to avoid! Besides, there is no guarantee that consumers will use the delivered cable. As long as it fits, they are like to use any cable at hand. And that is exactly what may lead to safety incidents. There must be more attention from industries and IEC committees on how to avoid use or inclusion of unnecessary parts by products, as to save resources.
12. How to recycle Printed Wired Boards?	Recycling of PWBs, in particular the extraction of the metals, exists already. There is a European standard covering for instance recovery of copper and precious metals (e.g. CLC TS 50625-5). Also the fiber and resins can be separated. It is claimed than materials up to 99% of purity can be recovered. We refer to the following article for a review of status: B. Ghosh, M.K. Ghosh, P. Parhi, P.S. Mukherjee, and B.K. Mishra, *Waste Printed Circuit Boards recycling: an extensive assessment of current status*, Journal of Cleaner Production, Volume 94, May 2015
13. Do you have any information about the Circular economy applied to the cable industry?	To answer this question, as promised in the webinar, we have checked with our representative for cable TCs in ACEA. According to him, the cable sector is actively working towards environmental goals whether it is energy efficiency, energy access, or the circular economy. It is easier to recycle cables – conductors can be completely recycled and most thermoplastics as well. While there is much more uncertainty for reusing them.

	This is in part due to the vast array of cable types and so complications in sorting and using the correct type. Also there are many installation rules to follow as well as many safety aspects to consider. The heat and mechanical cycles that a cable can be subjected to during its use can vary for the same type of cable in different installations. There is no recognized test procedure for a cable to see how much "life" it still has and so evaluate it can still be used (other than a destructive breakdown voltage test).
14. Would it make sense that every product Standard should contain a sustainability chapter?	It definitely would be wise to think about the economic, social, as well as environmental aspects that are addressed by the topics of each standard as to clarify how standards contribute to deliver wealth to society. As matter of fact, soon standards will be required to elaborate on how they contribute to the one or more UN SDGs (Sustainable Development Goals). This requirement will be included in the NWIP template soon.
15. Is the IEC interested or wanting to develop standards or recommendations for design thinking on providing maintenance of electrotechnical products easily? **The implementation of blockchain for refurbishing parts is already a reality on plane parts, so could we see something similar for other electrotechnical products in the near future from IEC?**	Blockchain is an interesting way to keep track of (used) parts. This technology might even be useful for recycled material. Currently a standard is being developed by IEC covering product circularity in relation to environmental conscious design (see page 20 of the webinar). It will mostly cover the principles of it. Another standard is related to material circulation (Iso DIS 14009), and although if offer interesting strategies, its focus is not product, but management system. New standards covering requirements for introducing material efficiency in the design of products, such as circular ready design as described in page 14 of the webinar, are highly needed. There are already plans for starting such standard in IEC under preparation. Maintenance is part of lifetime extension and will be included.
16. With reusable products, how will manufacturers keep control of third parties reworking and selling old products as refurb or new? How could this effect the manufacturers' reputation if the third party does not use manufacturer parts and cheap alternatives?	These are issues we are experiencing today already, not only with reuse but also with repair. Legislation is playing or will play an important role, for example requesting parties selling 2nd hand or refurbished products to identify such product as used or refurbished, and add their (trade) name and address to the product using e.g. labels on the product or if not possible, with the packaging material. Also traceability systems will need to be in place demonstrating how the product has been made ready for resell or how it has been refurbished. Standards will play an important role in supporting third parties on how to best handle these types of businesses. An example are the refurbishing standards by IEC/TC 62.
17. How will products be compared in terms of their environmental impact in the future? I think it will be difficult to compare, e.g. repaired products with new ones, isn`t it?	Products could be compared via environmental impacts/carbon footprint. Via LCA or similar methods, the effect of a repaired product (longer in use, but potentially higher use of energy) vs. a new product (potentially lower energy usage) could be assessed to decide how long a product should still be kept in use. Other important comparative assessments will be in relation to different material efficiency strategies: for example is a product better repaired or should it be given a longer life, or both? Sometimes for specific reasons, e.g. safety or performance, it is preferred to go in one or other direction (if not both): for example products that function with water: where there is the danger that opening a product, it will be too difficult to close it back, increasing risks of e.g. electrical shock, the best strategy is to ensure that product is given a as long as possible lifetime instead being easily repaired.

18. Is there an input requirement at IEC to put material efficiency into IEC standards? If yes, how to cover the different requirement of international requirements into the standard and how to update the requirements into standard?"	Material Efficiency should not be an IEC requirement. Instead it is common sense and should be adopted by industry at large. IEC standards are the means to support the industry to show the products are compliant.
19. The changes in the international requirements have fast changes much faster than the updating of the standards. Is there an umbrella standard for development of electronic and electromechanical components (e.g. transistors, resistors, relays, switches) which covered material efficiency?	This is a very true statement: the number and variety of new requirements, may be safety, EMC, chemicals or not, material efficiency, are changing much faster than the pace where we can maintain or improve our standards. We are not aware of an umbrella standard covering the electrical and electronic components used in our products. Some IEC/TCs are paying particular attention to components reliability and durability, like IEC/TC 56, developing generic/horizontal standards that can be used by product TCs.
20. Do you believe there is need from industry for 3rd party conformity assessment against the standards e.g. for repairability?"	The need for standards to support conformity assessment of material efficiency requirements will become needed either to demonstrate conformity with legislation or to support claims from manufacturers. Whether the assessment will need to be done by a third party or can be a self-declaration will depend on the local legislation that is applicable to that product. Third party conformity assessment is one option for material efficiency standards, however it is not mandatory.
21. How can we avoid programmed obsolescence?	Programmed obsolescence is not allowed, and it is even regulated in some countries. ACEA is currently writing a Guide for standard writers focussing on the “credibility of environmental claims”. Although it does not focus on obsolescence specifically, it brings principles, requirements and also guidance on how deal with this type of issue.
22. What about trade off management between EE and Material efficiency?	Although they are important, currently, there are no clear rules on how to balance trade-offs. This is future work. A possibility to balance different energy/material efficiency aspects would be to minimise environmental impact via LCA of different design options. As explained in question 11, some “concessions” can be expected towards saving materials or using them longer versus saving energy. This is for instance because we need materials to produce energy and currently LCA methods are not always able to give the full picture. Note: see also questions 11 and 12 for more details.
23. Is there any guidance in IEC documents about how to classify materials according to their reusability (circular economy)?	We are not aware if there is such a type of standards. Perhaps ISO standards or information by chemicals manufacturers or even recyclers. In particular compatibility of materials and the potential to separate them during recycling is important. This could perhaps be an opportunity for new standards!
24. Do you link production efficiency to circular economy?	Efficient production is an important part of the circular economy. You can see it in the building blocks of circular economy on page 10 of the webinar: “Circular Design and Production”. Poor production processes, leading to high usage of energy, because of for instance the need for transport of materials or parts, or high amounts emissions (to air, soil or water) or even many rejected materials or defect products that end up in the waste stream are examples of very poor management of resources. The principles of circular economy apply, i.e. optimise use of (natural) resources

	and minimize waste and instead try to create circular production processes. For instance: - produce and consume local - reuse water, energy and other resources back into the same production process in a closed system of for another purpose - put rejected materials back into the same process.
25. Is there any special project ongoing in regards of "circular economy of batteries"?	Currently there are discussions in Europe about ancillary action asking for mapping, identification and prioritisation of standardisation documents needed to support the material-efficient high-quality recycling and preparation for reuse of, for instance, waste batteries in relation to the presence of CRMs (Critical Raw Materials), Lithium and Nickel. The outcome of these activities will likely result in new requests for standardization by the European commission. Also in Japan there is increased focus on batteries in relation to circular economy.
26. Are there any mechanisms or tools at IEC level planned to further enable IEC TCs to address these issues, beyond encouragement and advice? E.g. in Europe the Standardisation Request mechanism plays that role.	International standards are often taken in national laws and standards. An example is the RoHS standard IEC 63000 that has now been taken by many countries in their laws and translated to their national standards. Timing is, however, a very important aspect. If the international standards are coming after the national laws have been written and mandates for standards are in place, then the chance of adoption is very limited. Note that IEC also contributes to European Standards, mostly through the Frankfurt Agreement (see related Webinar), where our IEC standards follow parallel vote in Europe and become a European "EN/IEC" type of standards.
27. is the CE principle based on the assumption that recycled materials are being used in the same industry/product or being used in any industry?	There is no limitation to where to use recycled materials. They can be used in the same type of product, same sector, or a complete different sector. Also materials that are waste in one industry can be used as feedstock in another industry. Issue is sometimes simple information availability. In a truly Circular Economy this type of information will be wide-spread and wastes can be in this way avoided.
28. There are a number of standards in different organizations and there must be overlaps between some standards. How do you think we can resolve such situations?	It starts with defining clear scopes for different TCs within the same SDOs and, where possible, across SDOs. In general we try to avoid overlap across SDOs by having liaisons. As long as people know from each other, there are reasonable efforts done to avoid overlap. Problem is when people don't know from each other they are developing similar type of documents. Or worse, when they don't agree with the content of the developed documents… To solve issues of overlap between IEC at international level and CENELEC at European level, the Frankfurt agreement was put in place. In this way it is possible for CENELEC to offer a published EN to IEC to be implemented at international level, and vice-versa, it is possible for IEC to offer a document for parallel vote in Europe. Similar exists for CEN and ISO, under the Vienna Agreement. For Circular Economy the chance for overlap is large, as many organisations are developing different types of standards. Therefore we need to pay extra attention to avoid it.
29. Slide 22, EN 45556" Method to assess proportion of reused components" will be offered to IEC. To which TC? TC 111?	Yes, this standard has been already offered through Frankfurt Agreement to IEC/TC 111. It is being picked up by the NL NC very soon.
30. Are there ideas/plans on how to define minimum requirements for the different areas of circularity? i.e. what is the technical minimum to call something	Minimum requirements have not been discussed yet. For recycled material, it can be quantified, how much recycled material is in a new product, i.e. X %. Something similar can be done for the recyclability of a product, i.e. how high is the percentage of a product that is likely

"recycled" or "refurbishment", as there may be a big range of "virgin" material involved, which consequentially big differences for circularity.	to be recycled at its end of life. For reuse of parts a refurbishment assessment method is available or under development. Minimum requirements are often defined in environmental labels like EPEAT in US, the EU Ecolabel, Blue Angel and Nordic Swan in Europe, etc. In the future, minimum requirements for material efficiency aspects are likely to be defined and become a requirement in legislation.
31. Are there specific industries that are actively adopting material efficiency standards and how could we encourage more industries to do so?	In Europe we see that the household appliance industry, heating industry, medical appliances industry, to name a few are already adapting or even developing standards in support of material efficiency strategies. In China there is focus into standards covering aspects like remanufacturing; Ecolabels will contain other material efficiency requirements. Japan is focussing standardization in particular on reuse of resources/recycling topics. Other countries and industries will follow, once the societal pressure is big enough.
32. Will there be considerations on including circularity measures, which are "outside" of the traditional product cycle (compensation, or carbon capture and storage coupled with waste disposal)?	In IEC the standards are often focussed of products, and therefore within the “product lifecycle”. In ISO, focus outside the product cycle can be expected, as their standards have a much broader scope. For instance standards are in development by ISO TC 323 to assess circularity at the various levels, macro (countries), meso, micro and nano (products). They will cover not only technological but also biological cycles and will combine LCA for environmental impact, Social LCA for social impact and Life Cycle Costing (LCC) for economic impact.
33. I see one standard of durability is on-going in EU, but we don't see standardization on reduction of material (or resource) volumes so far. Is that planned to be standardised somewhere? In your presentation, the two aspects of durability and less resource should be prioritized if I understand correctly.	Following the waste hierarchy, avoiding waste is the highest priority. This can be achieved by making a product longer lasting and/or using less materials for the same product. Currently, the ISO (DIS) 14009 touches upon the topic, although it does not go deep into it. This could perhaps be an opportunity for new standards!
34. If we think about the impact of reused parts to safety and reliability, do you think that these concepts will lead safety evaluation & conformity to more focused on component/part /material base independently instead of "testing and evaluating on end-product"?	Safety evaluation and conformity might be extended to component/part/materials. However, this will likely not supersede the concept of testing and evaluation on end-product, as parts might behave differently once built in a product.

ACRONYMS

ACEA – Advisory Committee for Environmental Aspects

CRM – Critical Raw Material

LCA – Life Cycle Assessment

REEE – Reused Electric and Electronic Equipment

SABE - Strategic Advisory Body on Environment

SDO – Standards Development Organisation

WEEE – Waste Electric and Electronic Equipment