

## **Circular Economy: Closing the Loop in Europe's material flow**

### **Executive Summary**

T&D Europe supports the European Commission's Circular Economy approach, however, calls for a more differentiated view regarding different product groups.

- T&D Europe supports the application of the EcoDesign initiative for energy related Products (ErP) for power transformers and its implementation through the EcoDesign regulation (EU) 548/2014 on the energy efficiency of transformers.
- Other T&D equipment, like high voltage switchgear, does not fall under the EcoDesign directive 2009/125/EC since it is not intended to consume electrical power. T&D Europe cautions regulators about having high expectations in extending the EcoDesign directive to further T&D products, since durability can hardly be determined and measured in advance, depending largely on actual environmental and operating conditions. T&D equipment is designed for a life time of 30 to 50 years based on the experience gained in the field.
- T&D Europe thinks that the CO<sub>2</sub> footprint is not appropriate as a circular economy metric, since it is not function specific, but depends on the plain integration of the mass of materials and on numerous cut-off criteria. LCA and LCCA evaluations should not be used in public procurement unless clear Product Category Rules have been agreed on. Even then large efforts are still required to avoid delivering misleading declarations towards consumers when comparing competing alternatives by using this method.
- High voltage switchgear, operated at voltages above 1 kV AC or 1.5 kV DC, and therein installed low voltage equipment does not fall in the scope of the waste directive WEEE (2012/19/EU). T&D equipment, like electrical switchgear and power transformers, are handled by professionals at the end-of-life, and components and materials are separated, re-used or recycled wherever possible. T&D Europe calls the EC to clarify re-use of T&D equipment at end-of-life as legal alternative to waste. Today this is regulated by different laws in EU Member States and not aligned throughout Europe.

- The consistency between RoHS, REACH and other waste legislation should be improved, and minimum quality criteria for secondary raw materials shall be created based on ISO, IEC and EN standards.

### Additional information

T&D Europe, the European Association of the Electricity Transmission and Distribution Equipment and Services Industry and its Members are clearly aware of their environmental responsibilities and welcome the effort of the European Commission to boost circular economy. We believe that environmental responsibility and economic progress go hand in hand, if EU authorities and industry join forces to develop innovative methods to the benefit of both interests.

Concerning electrical transmission and distribution (T&D) equipment, such efforts have to consider the high priority of durability and reliability of this equipment installed in the European power grid. The supply of electricity is an important backbone of society and economy and part of the critical infrastructure. Together with the Energy Union, Digital Single Market and the Internal Market for Products and Services, Circular Economy is one of the core pillars, which, if well designed and part of a joined up and coherent policy approach, will contribute towards the core overall sustainable jobs and growth objective as well as European technology leadership.

T&D Europe Members are fully committed to bring Europe to a low carbon economy in 2050. Our technologies can enable power systems accommodating the integration of the increasing share of renewable and distributed energy sources.

### 1. What is Circular Economy?

Circular economy is about saving and using resources in a more sustainable way, by the re-use, repair, refurbishment and recycling of products and materials in an (almost) closed loop. Energy and resources are utilized most efficient and waste is reduced to a minimum. Circular economy could reduce negative impacts on the environment, open opportunities for use of secondary raw materials and in the end it should increase European competitiveness and innovation.

On 2<sup>nd</sup> December 2015, the European Commission presented a new circular economy package. The package contains a series of actions planned for the coming years and comprises the update of six EC directives on waste.

- the waste framework directive (2008/98/EC) and amending Directive (EU) 2018/851
- the directive on landfill (1999/31/EC) and amending Directive (EU) 2018/850
- the packaging waste directive (94/62/EC) and amending Directive (EU) 2018/852
- the directives on end-of-life vehicles (200/53/EC),
- waste batteries and accumulators (2006/66/EC),
- waste electric and electronic equipment (2012/19/EU), and
- the amending Directive (EU) 2018/849.

In parallel, the European Commission promotes certain initiatives together with other stakeholders, e.g. standardization committees like CENELEC. The most important EcoDesign directive 2009/125/EC addresses the economical and environmental aspects of design, durability of products and energy efficiency of energy-related products (ErP) and was incorporated into CEN/CENELEC by the joint Working Group JTC 10 with more than 7 new work proposals.

This position paper highlights the different stages of the life cycle of electrical equipment in the scope of T&D Europe companies, i.e. mainly high voltage electrical switchgear including low voltage protection and control devices and power transformers for distribution and transmission, both operated at voltages above 1 kV AC or 1.5 kV DC. The main stages in the life cycle of these products, also covered by the circular economy package, are: design, use, end-of-life handling and recovery or recycling of materials.

## 2. EcoDesign of Products addressing in particular durability

The EcoDesign directive is one of the first tools the EU Commission issues for energy related products (ErP), including power transformers, to address circular economy.

The design of electrical transmission and distribution products is a complex development task where the handling of waste at the end-of-life is only one aspect of many. Much more important are the equipment's durability and reliability with respect to secure power delivery and cyber-security.

T&D Europe supports the EcoDesign Directive for power transformers and its application to ErP. Power transformers are intended to transform electrical power from one voltage level to

another and have considerable power loss during operation, which is intrinsic to its principle of working. Therefore it makes sense to design power transformers to be most efficient in energy transformation, i.e. reduce their power loss. The EcoDesign regulation 548/2014 covering transformers is therefore fully supported by T&D Europe.

High voltage Switchgear, on the other side, being installed in the nodes of electrical distribution and transmission networks, is intended to energize, deenergize and protect power lines and cables. The main functional requirement is reliable switching and the protection of assets and personnel at any time and under all circumstances. Power loss when transporting electrical power is by a factor of 1,000 lower than the typical power loss of transformers. Electrical switchgear does not consume any noteworthy amount of electrical power and therefore does not fall under the EcoDesign directive 2009/125/EC.

The design of all T&D products is much more determined by the target to achieve a high durability, i.e. a lifetime of 30 to 50 years, with persistent reliability to avoid undesired or frequent electrical network shutdowns. Under this regard, electrical equipment in the T&D sector differs from common EEE products which have considerably lower lifetimes.

Long-term durability of T&D products can hardly be determined and measured in advance, since it depends largely on actual environmental and operating conditions. Field experience and expert knowledge is the better method to assess durability. The two standards IEC 60076-7 and IEC 60076-12 for power transformers assume a mean life-time of 20 years and provide rules to assess the life-time reduction of insulation and windings if operated beyond the transformer's rated parameters. For electrical switchgear, operation outside its rated values is not permitted. Decades of experience should be acknowledged showing that switchgear might fail spontaneously and non-critically, e.g. at moving mechanical parts, but rarely at insulating or conducting parts due to its build-in safety margins.

Subsequently, T&D Europe supports the application of the EcoDesign initiative for power transformers, however, cautions the EC about having high expectations for every T&D product and in particular for other electrical transmission and distribution products like high voltage switchgear.

Based on long-term field experience the T&D industry has high knowledge in developing products designed for a life time of 30 to 50 years. In contrary to the suspicion of regulators that products have a „planned“ obsolescence, T&D equipment proved its long-term durability, being almost maintenance free and durable till its assumed end-of-life. Any real prediction of durability will not be legitimate, unless aging effects would be of purely thermal nature.

Repair and maintenance of power transformers and electrical switchgear is a method of life preservation to avoid pre-mature failures. It has to be ensured that the T&D equipment thereafter will fulfil all safety requirements as for a new product. However, the product's

design intention is to be stable and maintenance-free for the entire anticipated lifetime of 30 to 50 years. Generally this is in contrast to design easy replacement of product parts.

### 3. Consumption / use phase

According to the EcoDesign directive 2009/125/EC, further implementing measures can be imposed on products such as a Life-Cycle Assessment (LCA) or a Life-Cycle Costing Assessment (LCCA) with the intention to minimize the product's environmental footprint. Such measures can be imposed without scrutiny on products being manufactured and sold in the EU with quantities above 200.000 units. Though T&D products do not fall under this supplementation, T&D Europe wants to express its concern on the applicability of LCA and LCCA.

The CO<sub>2</sub> footprint of a product should not only consider power consumption during the entire lifetime of use, but also the CO<sub>2</sub> emission in the initial product production phase, during transportation and during the end-of-life handling. Manufacturers always try to limit the environmental footprint of their products and any saving of product's material, volume and weight also goes along with a reduction of the CO<sub>2</sub> footprint.

T&D Europe thinks that the CO<sub>2</sub> footprint as a circular economy metric is not appropriate for T&D equipment, since it is not function specific, but depends on the plain integration of the mass of materials. Additionally the CO<sub>2</sub> footprint is significantly influenced by the power loss during the product's use phase and its CO<sub>2</sub> equivalent heavily depends on the CO<sub>2</sub> emissions of the power generation. Material resource depletion and other environmental factors are also important. This implies that for T&D equipment it is appropriate to use CO<sub>2</sub> footprint just to indicate the result of a function based evaluation. And this shall not be used for comparison between products from different suppliers unless clear Product Category Rules have been agreed on.

The European Commission supports this with its Initiative "Strategy for long term EU greenhouse gas emission reduction" (Ref. Ares(2018)3742094 - 23/07/2018) by stating that "[...] required investments will need to support not only low-carbon transition, but also digitalisation, resource-efficiency and circular economy in a just and socially fair manner [...]".

Life-cycle cost analysis (LCCA) might be a tool to determine the most cost-effective option to produce, operate, maintain and finally dispose a product among different competing alternatives. However, for use in public procurement, it is difficult to express all these functions in monetary values. LCCA today has the same disadvantage as LCA, concerning environmental impact factors, requiring decisions which aspects shall be included with an undefined weighting factor and which not (cut-off criteria). Thus, large efforts are still

required to avoid delivering misleading declarations towards consumers when comparing competing alternatives by using this method.

#### 4. Waste management (WEEE), repair and reuse

Electrical equipment under T&D does not fall in the scope of WEEE (2012/19/EU), even after its renewal in 2012. Definition Art. 3 (1a) excludes equipment above 1 kV AC and 1.5 kV DC from the scope of WEEE. In addition, low voltage EEE components are exempted when they are solely used in high voltage electrical equipment such as e.g. protection relays, instrument transformers for measuring high current and voltage, or special auxiliary switches which are otherwise not sold separately in the market place<sup>1</sup>.

Manufacturers design and manufacture products in a way to give users/customers the highest benefit of their investment in terms of functionality, reliability and durability. At the end of the predicted lifetime of a product the question always arises whether the product can be re-used following an assessment and some refurbishment or whether it has to be declared as waste since the risk of failure during prolonged operation rises.

Electrical switchgear and power transformers contain valuable raw materials such as copper, steel and aluminum. These materials can be easily separated, collected and re-used after dismantling the equipment at end-of-life. Other materials are more difficult to separate, since they are integrated as a component, like vacuum interrupters. Therefore, it makes sense to collect and return switchgear and power transformers at the end-of-life to the manufacturers or third parties handling them on their behalf.

In particular for power transformers, there is a market for refurbished transformers, where aged windings are replaced by new ones, maintaining all rigid transformer materials. However, in this case, energy efficiency cannot be adapted to latest requirements since efficiency depends on these rigid materials.

A market for refurbished electrical switchgear does not exist today. However, sometimes switchgear is maintained on site by replacing components with shorter life-time, such as control and protection devices, current and voltage detectors or operating mechanisms. A design guideline to facilitate such a replacement is not required since these components are already separated by design and intended to be exchanged by new components with similar functions.

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<sup>1</sup> For details refer to the T&D Europe position paper on the “DIRECTIVE 2012/19/EU ON WASTE ELECTRICAL & ELECTRONIC EQUIPMENT WEEE2” published 2018-05-16.

T&D Europe supports a responsible end-of-life handling of T&D equipment and the re-use of materials to reduce waste. For gas-insulated switchgear, for example, T&D Europe Members and its customers long time ago have signed self-commitments in some European countries to take care of this switchgear at the end-of-life or mandate third parties to recover the insulating gas SF<sub>6</sub>, representing one re-useable material from this type of switchgear.

In general, electrical switchgear and power transformers are erected but also dismantled at its end-of-life only by professionals who responsively take care of the products and all its components installed. Under these premises, the EC should clarify that electrical T&D equipment, like switchgear and power transformers, can be handled as products for re-use and not as waste, concurrent to exempting them from the waste framework (2008/98/EC) of the circular economy package which in fact primarily targets private consumers. Today end-of-life treatment of these products is regulated by different laws in the EU Member States which are not aligned throughout Europe. This misalignment creates a lot of uncertainty among users whether their equipment has to be treated and declared as waste with related obligations to differentiate between different types of waste. Keeping in mind that electrical equipment at its end-of-life a priori is not hazardous waste, T&D products could be handled in a simpler way under an extended, European-wide aligned voluntary commitment, which leaves the mandated waste management facilities to decide which parts of the product have to be declared as waste and which parts can and shall be re-used.

T&D Europe thinks that, according to article 8.6 of WEEE (2012/19/EU), these waste treatment facilities should mandatory be certified, as e.g. required for SF<sub>6</sub> handling by the F-gas regulation (EU 517/2014).

## 5. Secondary Raw materials

T&D equipment contain valuable raw materials which can be easily separated, collected and re-used. Due to the character of the equipment, all materials are today already applied with special care and predominately recycled at the end-of-life.

The market will, however, only accept secondary raw materials when these materials comply with existing specifications. Minimum quality criteria and standards for secondary raw materials should be developed (e.g. as in IEC 60480: *“Guidelines for the checking and treatment of sulfur hexafluoride (SF<sub>6</sub>) taken from electrical equipment and specification for its re-use”*), and secondary raw materials need to be REACH compliant. However, REACH has the tendency of posing very low limits to some substances which might accumulate in re-used and recycled materials, making them sometimes unusable. This has been also recognized by the EC (see communication SWD(2018)20).

Consistency between RoHS, REACH and other waste legislation in the electrical and electronic equipment (EEE) sector will have to be improved, also by developing accepted quality criteria for raw materials. The international standard IEC 60480 is an example, where quality criteria for used SF<sub>6</sub> have been developed.

#### ABOUT T&D EUROPE

T&D Europe is the European Association of the Electricity Transmission & Distribution Equipment and Services Industry, which members are the European National Associations representing the interests of the electricity transmission and distribution equipment manufacturing and derived solutions. The companies represented by T&D Europe account for a production worth over € 25 billion EUR, and employ over 200,000 people in Europe. Further information on T&D Europe can be found here: <http://www.tdeurope.org>

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