MINUTES

MEETING OF THE CONSULTATION FORUM ON THE ECODESIGN OF ENERGY-RELATED PRODUCTS

REVIEW OF REGULATION EU 548/2014 FOR POWER TRANSFORMERS

31 October 2017 (10-17H), CCAB, meeting room 0C, Brussels

1. Welcome and introduction

The agenda was endorsed without amendments.

The Commission indicated for information that the minutes of the Consultation Forum (CF) meeting held 17 February 2017 on ecodesign of Servers and Data storage products had been uploaded to CircABC platform, including comments made by MS to the draft minutes. No further comments were provided, so these minutes were approved.

UK indicates their concern for the cancellation of a programmed CF meeting on ecodesign of standby products (14 November 2017) and the delay in the distribution of the documents for the programmed CF on dishwashers and washing machines (22 and 23 November 2017).

The Commission services presented the context of the review forecast in Article 7 of the existing Regulation EU 548/2014.

2. Presentation by VITO of key issues for the review of Regulation EU 548/2014 on Power Transformers

The study team leader, presented the main findings of the review study, which could be summarised as follows:

- Tier 1 requirements have been successfully fulfilled at a lower cost (approx. -30%) than initially anticipated, thanks to the use of different materials;
- There may be retrofitting issues due to space/weight constraints in so-called brownfield sites, as opposed to greenfield sites; it has been estimated that this may affect 27% of the installed base by rated KVA;
- Tier 2 requirements are expected to be cost-effective for greenfield sites and technically feasible for medium power transformers in brownfield sites, but not necessarily for very large power transformers;
- The use of minimum Peak Efficiency Index (PEI) values could offer lower...
losses when the kPEI (equivalent load factor) matches the real loading, but there is no consensus on the impact on the initial cost, as production costs might raise due to the proliferation of transformers designs.

- The use of Tier 2 requirements with fixed losses will always result in lower losses independently of load conditions because both load and no load losses are reduced.

Euroelectric: indicated that the estimate of 27% of brownfield locations was probably very conservative. Own calculations indicate at least 60%. The 30% larger volume is a reasonable estimate and results in costs, but the costs of larger weight shall also be added. As a consequence, the 30% decrease in price is not real, and probably the contrary is true: their own estimates indicate a 20% cost increase for compliance with Tier 1. Similar expenses can be expected for Tier 2. The figures for brownfield sites affected by retrofitting issues should be based on number of actual substations, not on a weighted average by rated KVA.

VITO answer: agreed that the values provided were rough estimates. Additional data to make better estimates would be welcome.

Sinerggrid: Their experience with tenders is that while they got bidders complying with Tier 1 requirements, they did not get any with tenders that specified Tier 2 requirements. They assume this is due to the serious size increases.

Belgium: Asked whether the retrofitting problems discussed above could be sorted out by means of (national) exceptions.

Sinerggrid: They do not think that it is a particular issue of Belgian networks. They think adaptation of tenderers and bidders to Tier 2 will be very tight.

3. Presentation by T&D Europe – technology implications and international comparison

The representative of T&D Europe, presented the key issues for the manufacturers, this is, the ambition level, a comparison with other world regions and countries, and the difference in resin/liquid transformers.

The regulation has helped technology development. Errors of cost estimation can be explained by the differences in technologies. The use of minimum PEI values will have a number of drawbacks, destabilise the market and create trade barriers. If minimum requirements were to be changed to PEI values, he would expect an impact assessment study to be carried out with new data. He recommends minimum changes in the revision, and provide long-term certainty to market players.

Eurelectric: Replied that they are in favour of more design options (fixed losses/PEI), as this allows to adapt to different loading conditions. If no choice is possible, some technological choices will be excluded from designs.

CLASP: Asked for clarification of the term regulatory 'concession'. The reply given was that derogation is what was meant.

Belgium: Explained that dual voltage installations are need in Belgium for
historical reasons. They would need a very long term derogation period to gradually replace the installed base.

ENEL: Wondered whether Tier 2 is technically feasible. For them transformer design is always a balance of energy savings versus material choice.

They estimate a 50% weight increase for 3-phase transformers to meet Tier 2 requirements. Exclusive use of Copper would be needed to fit the size, but this has important consequences for total weights: adaptation to these conditions cannot be done so quickly. Additionally, he mentioned the problem of copper theft in Italy.

**Presentation by Eurelectric – the perspective of utilities**

The representative of Eurelectric presented the view of electricity companies with respect to the review of Regulation EU 548/2014. Tier 2 requirements are technically possible but higher weight and size will increase costs, which will result in unclear payback times. For large power transformers Tier 2 is achievable.

He explained that utilities are regulated and obtain no economic benefit from buying cheap transformers, as national regulators can disallow expenditure on inefficient transformers purchased.

He explained that if the change of a transformer involves not only the replacement of the transformer itself, but also civil work (pole, door, substation), then it is hardly possible that the upfront investments are paid back in reasonable periods of time.

He indicated that a possible solution could be a renegotiation of the date of application of Tier 2 requirements.

With respect to the question of repaired transformers, he indicated that the replacement of bushings and tap changers should be considered as maintenance operations.

Hitachi Metals: Indicated that the loss capitalisation factors are key to calculate the costs right and that these vary from Member State to Member State.

Eurelectric: Agreed with Hitachi and explained that there are variables like the discount rate, where EU averages are used and where a 4% is assumed horizontally.

Furthermore, he explained that Tier 1 will be a success in 95% of cases and that the few exceptions are special designs, which will hardly meet Tier 1 and neither Tier 2 requirements. He explained that, in general, if Tier 2 does not work, Tier 1 will not work either. However, it is better to design with Tier 2 in mind, and use Tier 1 as fall-back option.

European Copper Institute: Indicated that the assumptions of costs and savings are very conservative. He explained that one has to be careful with assumptions implying load changes, as exploitation of transformers is not that flexible. He believes there is risk for loopholes in using PEI values.

Eurelectric: Replied by saying that he did not see the loophole risk in using PEI
values. He repeated that utilities are regulated by national authorities and that it does not make sense for them to cheat in specifying transformers’ designs.

4. **Presentation of the working document and key discussion issues of the review, by Commission services**

The Commission policy officer presented the consultation document through slides and moderated a discussion taking the document in different sections.

**Definitions and exemptions**

It was proposed to consider the inclusion of a definition of declared value, as there is some confusion amongst manufacturers about what this actually is. It was also proposed to bring the definitions of medium power and large power transformers in line with the latest corresponding definitions in supporting EN standards. Finally, it was explained that the definition of pole-mounted transformers need some updating to prevent abuse.

It was also explained that the definitions in the list of exemptions of the current regulation needed to be completed. A new exemption has been proposed for medium power transformers specifically designed and qualified to ensure safety of nuclear installations, which could rest in Article 3 of Directive 2009/71/Euratom for its definition.

NL: Explained that there can be differences between measured and declared values, but these cannot be in favour of the manufacturer. This shall be aligned with other Ecodesign measures. If there are more complete definitions in standards, those should be used in the regulation’s text.

IT: Agreed with NL that ‘declared value’ should be a horizontal definition across Ecodesign measures and that it can be different from ‘measured’ value.

DE: Agrees with NL and IT.

SK: Will submit comments in written form.

T&D: Notes the exceptions necessary for transformers in nuclear power facilities.

EDF: Explained furthermore that for nuclear facilities Tier 1 requirements are not always technically possible.

UK: Supports the exemptions for transformers in nuclear plants.

Synergrid: A definition of medium power transformer for 36kVA will be needed. They will provide a definition.

**Energy efficiency requirements for single phase transformers**

The Commission explained that single phase transformers are only used in the UK and in Ireland and that there is little economic incentive in introducing minimum load losses requirements. Cost-effective minimum requirements for no load losses would be possible, but only with minor energy savings.
Introducing minimum requirements for single phase transformers would address the current regulatory asymmetry with respect to three-phase transformers, but stakeholder feedback indicates that there is no risk of substitution effect in not regulating them.

IE: They could live with single phase being regulated, but wondered if it really worthwhile regulating them.

UK: There have been no imports of inefficient single-phase transformers in the UK since 2015. The UK is not convinced of the opportunity to regulate these transformers at EU level and believes that subsidiarity should rule in this case.

Cost-effectiveness of Tier requirements for three-phase medium transformers

It was explained that the review study could not conclude that existing Tier 2 requirements were cost-effective in all possible locations and scenarios. Although Tier 2 compliant transformers always have lower lifecycle costs than Tier 1 compliant transformers and are technologically feasible, there may be retrofitting issues into existing substations, because of weight and size limitations. The extent of this retrofitting is uncertain because manufacturers and electricity companies were not in a position to share the necessary data to the review study, which quoted an estimated figure of 27% of the installed rated power.

The Commission explained that a potential amending regulation could not cater for all possible cases in advance and that therefore, where duly justified, some sort of regulatory relief should be considered when replacement costs become disproportionate or no technical solutions exist to meet Tier 2 requirements. The Commission proposed an ex-ante derogation mechanism, where the market surveillance authorities would grant a regulatory derogation on a case-by-case basis based on technical and economic documentation from the manufacturer and the tendering process of the transformer(s) in question.

In cases where Tier 2 requirements cannot be met, it was suggested to use Tier 1 requirements as a fall-back option. The review study also recommended imposing maximum specific core losses for magnetic steel as an additional requirement.

Option 1. 1:1 replacement must be guided by proportionate costs. Left open to relevant authorities to interpret.

AT: Asked whether national market surveillance authorities (MSAs) had been consulted on this proposal and how they could deal with it.

DE: Indicated that the Commission’s proposal would represent an enormous burden on MSAs. DE would propose a formulation to 'only check documents on demand'

IE: Added that the burden on testing also needed to be clarified.

BE: Proposed to split existing Tier 2 in two stages, to ensure the energy savings.

UK: Questioned whether national market surveillance authorities are in a position to be doing this kind of work, or whether other parts of the administration would
be better placed to do it. This would need in any case a discussion with the Ecodesign ADCO group.

SE: Stated that a discussion should not be reopened on rules already agreed in 2014, as changing rules would penalise early adopters. SE questioned whether the 4% discount rate is appropriate for the lifecycle cost calculations. The discount rate should be revisited, as this market is almost monopolistic.

Clear signals are needed to drive innovation in the market place.

For MSAs, the Commission's proposal is a burden, and is unrealistic.

IT: While the principle of the Commission’s proposal is fine, for the MSAs the reality is different and the proposal is most probably not feasible. Italy explained that it might be more practical to perform an ex-post control of the techno-economic justification that might lead economic operators to install transformers which are not Tier 2 compliant.

CZ: Concurred that the burden the proposed derogation mechanism would impose on MSAs is worrying.

SK: Agreed with other Member States and indicated that written comments will follow.

FI: Supports SE

They also wonder how many brownfield cases actually have volume limitation. The basis for the estimate in the review study seems weak

CLASP: Would like to suggest a redesign of the proposal based on four criteria, which they will be sending in written form. In their view, cost-effectiveness should prevail over exceptionality. He explained that in the US they have strict criteria and they manage it well. The formulation 'disproportionate costs' is very vague, and uncertain. He added that there is a need for a technological feasibility criterion to be considered in the proposed derogation mechanism.

ECOS: In their view, the need for the review has not been properly justified. They would welcome data on the impact on the savings, in case major changes were to be proposed to the existing regulation.

NL: Cost-effectiveness in ecodesign measures is always done including exceptions, and it does not need to be justified for all cases and circumstances. It is unreasonable to expect to be able to gather data for all and every special condition or location. The wording 'disproportionate cost' sounds vague and there is a risk that each MS can interpret it differently.

EC: Explained that the wording "disproportionate costs" is already included in the existing regulation and that it is also used in other Union legislation. Although it would be tempting to provide more concrete guidance on when costs can be considered disproportionate, the downside is that this might be regretted for being too prescriptive one day, so finding a good balance is necessary.

Thyssen Krupp: Explained that, in the recent past, technological progress had exceeded expectations in term of the quality and thickness of magnetic steel.
They continue investing in R&D and reassured the group that no availability problems for magnetic steel are to be expected.

Hitachi Metals: Took the opportunity to explain that amorphous steel has 1/3 of the resistance of conventional magnetic steel and that no problems of availability are to be expected either.

Specific core losses

Eurelectric sees a disproportion between the potential savings and the cost of core loss measurement. MSAs can always make audits, although these would be costly. System thinking is necessary. When investing, one has to think if the right place is the transformer, or the transmission line, or generation, or other areas in the network. One needs to keep a discount 4% rate all over for simplicity.

EC: Welcomed written feedback to settle this discussion. The goal is to present clear, predictable rules for the applicability of Tier 2 requirements and for a fall-back mechanism to Tier 1 requirements.

BE: Would welcome to define quantitatively what is or is not disproportionate. Alternatively, this could be decided at the regulatory committee

Minimum requirements based on Peak Efficiency Values (PEI) values

The Commission explained that the review process has considered the possibility to introduce minimum energy efficiency requirements for medium power transformers based on PEI values. PEI values are already used in the existing regulation, for large power transformer.

Various options were presented, where these requirements would be introduced instead of, or on top of, existing requirements based on maximum levels of losses.

Eurelectric: Explained that the best way to optimise transformer designs is to use loss capitalization, but that this outside the remit of the Ecodesign Directive. Affirmed that if efficiency requirements are too strict (i.e., Tier 2), all medium power transformers may end up being sub-optimised.

SE: Would not see any problem if there were more than one option for demonstrating compliance, this is having both maximum losses and minimum PEI values as proposed by the Commission in Option 2C. However, SE would prefer the option of maintaining the fixed loss approach and reviewing it in the next review process.

NO: Is in favour of option 2A, maintaining fixed levels of maximum losses, as they think the rest of the options would open loopholes.

BE: PEI adds complexity, and does not solve anything, it is not requested by manufacturers, it could only help utilities to optimise their transformers’ designs.

Norsk electricity: Stated that the use of the PEI will not allow for technological development.

Eurelectric: The stagnation of technological development is a theoretical
forecast, but makes little sense for utilities. If utilities wanted to cheat, they would do it using easier mechanisms, such as under-dimensioning the transformers for the foreseen load.

**Regulatory Concessions for large power transformers**

The Commission explained that the review study recommended extending the current regulatory concession for the replacement of one-to-one large power transformers to new transformers, when their installation entails disproportionate costs or is technically unfeasible.

The Commission proposed a derogation mechanism similar to the one made for medium power transformers, with a fall-back on Tier 1 requirements and the possibility to impose maximum specific core losses. This is presented as option 4 in the consultation document.

The Commission then explained that if Option 4 for new transformers was accepted, the existing regulatory concession for replacement transformers would need to be brought in line with it, in terms of the fall-back into Tier 1 requirements and/or the maximum core losses (Option 5 in the consultation document).

**NL**: In reference to the proposed Option 4, NL asked whether there is any data available about how many times the existing exemption clause for large power transformers has been used.

**EC**: The Commission explained that none to the best of its knowledge and queried the group for any other relevant information in this respect.

**CLASP**: Affirmed that this represents good news and that if one wants to achieve energy savings, the criteria have to be strict.

**ENTSO-E**: Explained that the existence of loopholes is a novelty to them. There is no benefit in cheating and PEI values and capitalisation factors is what they use in their transformers’ technical specifications.

**DE**: Supports options 4 and option 5, but they do not like the administrative burden that it represents.

**EC** concludes that there seems to be wide acceptance for options 4 and 5, but that the fall-back options need to be thought through, as there does not seem to be much support for the inclusion of a requirement on maximum core losses.

**Regulatory Concessions for transformers with rated power below 4MVA and voltage higher than 36kV**

The Commission explained that power transformers with rated power below 4MVA and voltage higher than 36kV are somehow trapped into two categories in the existing regulation and that applicable requirements in Tier 2 would result in disproportionate large dimensions.

The proposed solution is to introduce a new sub-category of large power transformers with highest voltage for equipment in between 36kV and 72,5kV together with appropriate minimum requirements which have been proposed by CENELEC TC 14 (this is option 6 in the consultation document).
T&D: Explained that the proposed values for Tier 2 in the table in option 6 are somewhere between the values for Tier 1 and 2 for other large power transformers above 72.5 kV.

EC: Asked for written proposals to complete the discussion on this Option 6 and explained that there must not be any gaps in the legislation.

Regulatory concessions for transformers with unusual combinations of winding voltages

The Commission explained that the existing losses allowances for transformers with unusual combinations of winding voltages might need to be reconsidered as some cases of abuse have been reported for dual voltage windings.

Synergrid: Indicated that they will be sending written feedback to help formulate a phase-out of the allowances, in particular in the case of full use of both windings.

T&D: Supported that this could help to phase out these regulatory concessions.

Regulatory concessions for pole-mounted transformers

The Commission proposed to introduce limitations to the existing concessions for medium power pole-mounted transformers. These were granted in the first regulation because of weight limitations to mount transformers on the support structures of overhead power lines. Options presented included a time limitation for the existing concessions and/or restrict these concessions for one-to-one replacement of existing pole-mounted transformers.

IT: Asked whether pole-mounted transformers are really needed. If not needed, then postponing deadlines will not help to phase them out.

PT: Explained that it is all a matter of investments because to bury/ground transformers is 3 times more costly than installing them on poles. Therefore 8A is not an option for Portugal. PT favours Option 8E and will be sending written comments.

BE: Indicated that the same verification procedure should be followed whether transformers are pole or ground mounted.

FR: Stated that the question of pole-mounted transformers is important to France because FR has many of these transformers in operation. For France Options 8C and 8E are preferred.

ENEL: Claimed that if copper is the solution to make these transformers more efficient, then there is an issue, because there are still many cases in Italy of copper theft.

SK: Prefered Option 8C

DE: Prefered Option 8C

EANDIS: Claimed for the need of a long derogation period as 10 years is not enough.
UK: Will wait to read the additional information to be provided by PT.

Eurelectric: Explained that load factors in pole-mounted transformers are relatively low and that the typical lifetime of a pole-mounted transformer is 50 years. Eurelectric would be in favour of Option 8C, but they would like to see a revision of Table I.3 with the losses allowances.

EC: The Commission took note of the support given by a number of Member States to Option 8C, this is to restrict the allowances for one-to-one replacement transformers.

DuPont Poland: Indicated that allowing concessions for one-to-one replacement transformers would actually mean allowing these concessions for the majority of pole type transformers. That is because majority of pole type transformers are for replacement of existing units.

CLASP: Disagreed that 8C would be a good idea and stated that the regulation should be more ambitious in terms of energy savings.

Other environmental impacts

The Commission explained that the review study had confirmed that the impact of energy consumption during the service lifetime of transformers remains dominant. No evidence has been produced to support proposing environmental requirements other than minimum energy performance/efficiency. The only option that could be considered is to make the information related to the bill of materials more easily available to further facilitate recycling at the end-of-life.

DE: Transformers consist of recyclable materials and therefore there is no need of a better Bill of Materials (BOM). Germany explained that noise levels from industrial applications are regulated in their Member State and that there may be a conflict between energy efficiency requirements for transformers in Tier 2 with national levels on noise. Germany asked the Commission to help identify if similar problems might exist in other Member States.

IT: Italy stated that the discussion on requirements to facilitate recycling belongs to a wider horizontal discussion on material efficiency criteria for all regulated products.

SE: Supported that information on the BOM should be made available, in a format that would be useful after 30 or 50 years of service.

Eurelectric: Stated that noise can also be an issue for small pole-mounted transformers.

Miscellaneous topics – Small power transformers

The Commission explained that small power transformers are in the scope of the current regulation, but only for product information requirements, not for minimum efficiency requirements. However, the expected growth in the market for electric vehicles may cause a substantial growth in the market for LV/LV small transformers and may advice introducing minimum efficiency requirements. The Commission proposed to look into this question as part of the next review, tentatively in 2023.
ECOS: Advised not wait for the next revision, and ask already for information and move on with standards under development.

EREA: Confirmed that the market for transformers below 1kv (Low voltage segment) is a growing segment (e.g. for vehicles)

CLASP: Put forward the idea to propose an energy label for these type of transformers.

Miscellaneous topics – Technology neutrality between dry-type and liquid immersed transformers

The Commission explained that the current regulation sets out different minimum energy efficiency requirements for liquid immersed and dry-type transformers. This is seemingly not technology neutral and is explained by their different behaviour and the fact that they are not interchangeable in their applications and constitute separate markets. The Commission proposed to investigate the possibility to adopt a completely technology neutral approach in the minimum requirements for liquid immersed, dry-type and possibly electronic transformers, as part of the next review, provisionally in 2023.

T&D: Explained that it is not possible to be technology neutral, as there is too much difference in application segments.

Cenelec: Indicated that there is an IEC ad-hoc group that has been set-up and that will follow up developments there.

SE: Confirmed that there is no reason to be technology neutral, too different application

DE: Agreed with SE.

Dupont Poland: Disagreed and stated that, not always, but in many cases these technologies compete.

UK: Advised to start collecting data already to inform the next review

Miscellaneous topics - National deviations in standard voltages

The Commission explained that national deviations in standard voltages in electricity distribution grids exist in Czech Republic. These standard voltages are used as thresholds in the Regulation to characterise which minimum energy performance requirements are applicable to three-phase medium power transformers with rated power below 3150 kVA. Therefore, Tables 1.1, 1.2, 1.3, 1.4, 1.5, 1.7 and 1.8 in Annex 1 of the Regulation need to be read in conjunction with the referred existing national deviations.

The Commission proposed to add text in the regulation (possibly in Article 3) to allow Member States notify the Commission about the existence of national deviations in standard voltages in electricity distribution networks, which require a different interpretation of the applicable requirements in Tables 1.1, 1.2, 1.3, 1.4, 1.5, 1.7 and 1.8 in Annex 1. The Commission would then make this notification publicly available.
CZ: Agreed with the Commission's proposal.

ENTSO-E: Agreed to closing this gap

EC: Explained that the purpose of the public notification would be to help identify which tables in Annex I of the Regulation would be applicable for which voltages for equipment and that public notifications applicable in a given Member State would have no effect on those Member States where voltage deviations do not exist.

Miscellaneous topics - Repaired transformers

The Commission explained that the current Regulation does not contain any provision on the treatment of repaired, refurbished or retrofitted transformers and relies on the Blue Guide.

It was proposed that power transformers which fall in the scope of this Regulation could be considered as new products when, as a result of a repaired/retrofitting operation, their energy performance and/or the life expectancy have been substantially increased.

More specifically, a repaired/retrofitted transformer shall be considered as a new product when the following operations have been performed:

- Replacement of a complete active part with a new one providing increased energy performance, for instance replacement of the complete phase of a single phase transformer, of the three phases of a three phase transformer or fixing/replacing a whole magnetic circuit with new steel
- Replacement of the tap changer, of the bushings and of the complete insulation

Power transformers will not be considered as new products when routine repair operations have been performed.

BE: Asked what happens with the exchange of transformers.

IT: Welcomes the addition of new vs second hand clarifications, but would like to see it horizontally for all product group discussions

SK: The second bullet is not acceptable.

Laborelec: Asked what the interface with commercial guarantees is.

EC: Clarified that commercial guarantee is a matter of private contracts under national law.

T&D Europe: The bushings and tap exchanges shall be considered as maintenance operations, which do not make the transformer new or refurbished

Eurelectric : Agreed with T&D Europe.

ENTSO-E: Agreed.
SE: Also agreed, but stated that being too strict on what is considered ‘new’ may hamper refurbishment.

5. Conclusions

The Commission thanked the participants for their contributions and explained that the next steps would include the drafting of an amending regulation, the usual steps of inter-service consultation and WTO notification and that it would be working to hold a meeting of the Regulatory Committee in May 2018, with a view to having the amending regulation included in the package for adoption in winter 2018.
<table>
<thead>
<tr>
<th>Commission Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
</tr>
<tr>
<td>Belgium</td>
</tr>
<tr>
<td>Bulgaria</td>
</tr>
<tr>
<td>Czech Republic</td>
</tr>
<tr>
<td>Norway</td>
</tr>
<tr>
<td>France</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>Ireland</td>
</tr>
<tr>
<td>Italy</td>
</tr>
<tr>
<td>Lithuania</td>
</tr>
<tr>
<td>The Netherlands</td>
</tr>
<tr>
<td>Portugal</td>
</tr>
<tr>
<td>Finland</td>
</tr>
<tr>
<td>Sweden</td>
</tr>
<tr>
<td>The United Kingdom</td>
</tr>
<tr>
<td>Cenelec</td>
</tr>
<tr>
<td>Eurelectric/ESB Networks</td>
</tr>
<tr>
<td>ECOS</td>
</tr>
<tr>
<td>EDF Production Ingenierie Nouveau Nucleaire</td>
</tr>
<tr>
<td>EDP Distribuicao</td>
</tr>
<tr>
<td>ENEL</td>
</tr>
<tr>
<td>EREA Energy Engineering BVBA</td>
</tr>
<tr>
<td>ENTSO-E</td>
</tr>
<tr>
<td>Brussels Direct</td>
</tr>
<tr>
<td>Norsk Elektroteknisk Komite</td>
</tr>
<tr>
<td>Hitachi Metals Europe GmbH</td>
</tr>
<tr>
<td>Piraeus University of Applied Science</td>
</tr>
<tr>
<td>CLASP Europe</td>
</tr>
<tr>
<td>T&amp;D Europe</td>
</tr>
<tr>
<td>ENEDIS</td>
</tr>
<tr>
<td>UK Power Networks</td>
</tr>
<tr>
<td>VITO</td>
</tr>
<tr>
<td>BDEW</td>
</tr>
<tr>
<td>DuPont Poland</td>
</tr>
<tr>
<td>Laborelec</td>
</tr>
<tr>
<td>European Copper Institute</td>
</tr>
<tr>
<td>ORGALIME</td>
</tr>
<tr>
<td>ThyssenKrupp Electrical Steel</td>
</tr>
<tr>
<td>EDF</td>
</tr>
<tr>
<td>Eandis</td>
</tr>
<tr>
<td>Energy Networks Associations</td>
</tr>
<tr>
<td>Synergrid</td>
</tr>
</tbody>
</table>