



**Study for the review of Commission Regulation EU 2019/1783  
Ecodesign of small, medium and large power transformers**



**2nd Stakeholder meeting**

**Laurent Petithuguenin – Project Manager  
Tom Lock – Project Director**

16 January 2024



## Housekeeping rules of the meeting

- During each sub-session of presentation, virtual participants will be able to pose written questions or to ask for the floor (type [name organization] + 'floor please' [+topic]). Please write them in the chat when invited to do so by the Chair, starting with the name of your organisation (questions without the organisation name will not be considered).
- The questions will be answered at the end of each sub-session. In case of time constraints, priority in replying to the questions will be given, based on the order in the chat. Everyone remains muted (unless speaking when invited by the Chair)
- **Concise** intervention or question

NB : The chats will not be kept/copied. Please do **not** make comments in the chat area unless invited by the Chair.

# Agenda

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- Study overview and revised timeline
- Phase 2 Overview
- Phase 1 review of items a-r draft recommendations



# Study Overview

# Scope

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## **Phase 1 – Technical analysis**

This involves a detailed assessment of all items raised in the review section of Commission Regulation (EU) 2019/1783 plus the other items raised by DG GROW, as well as an update to the Ecodesign frequently asked questions (FAQ).

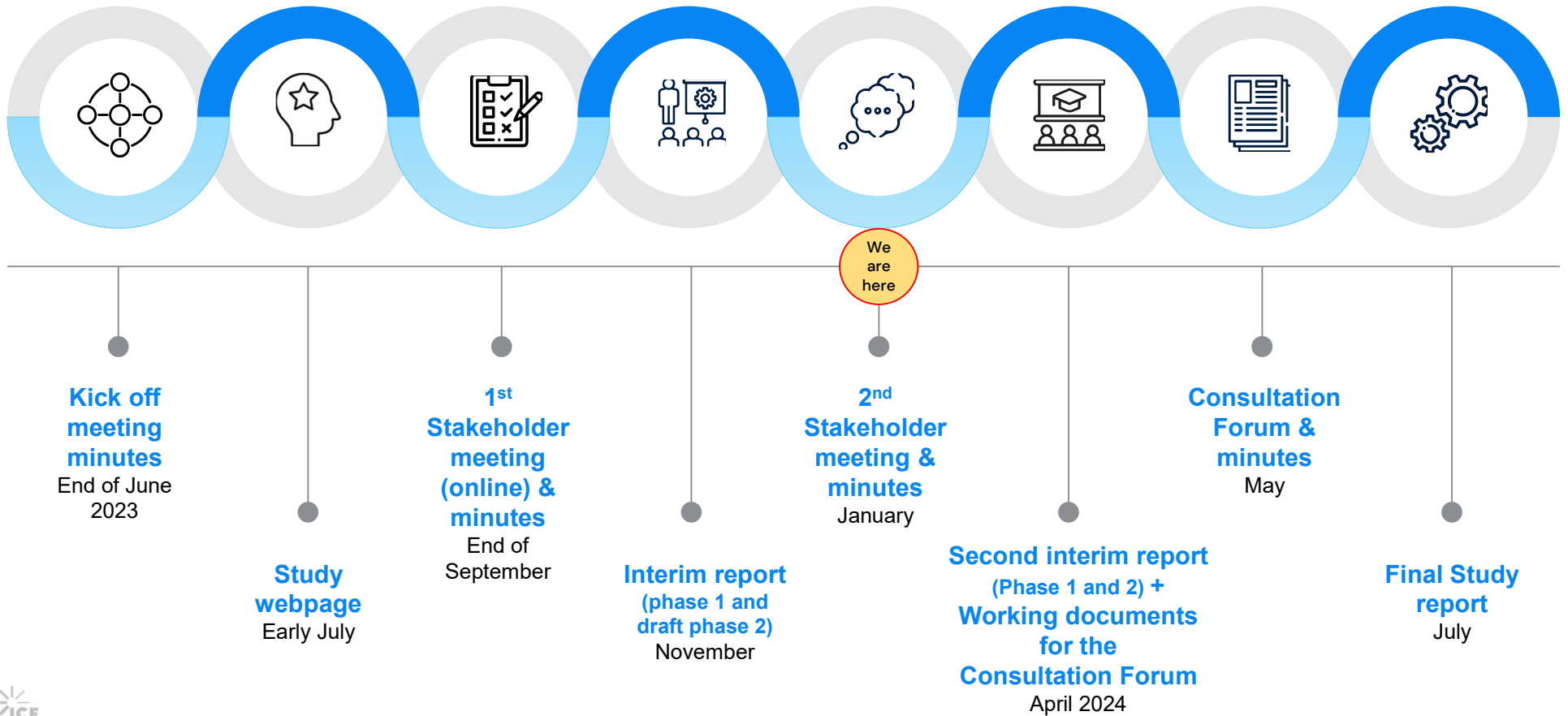
## **Phase 2- Update of the preparatory study for the transformers Regulation**

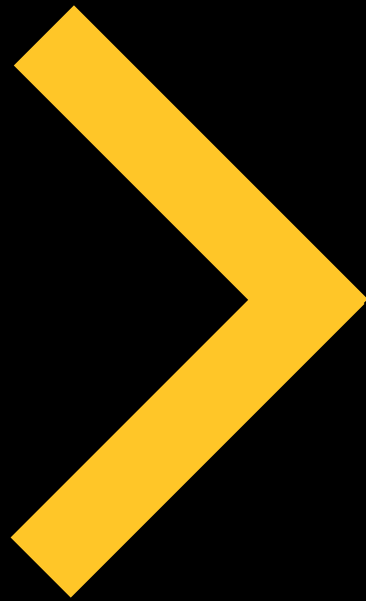
This phase will update the existing preparatory study of Commission Regulation (EU) 2019/1783, informed by Phase 1, and further by additional market research, consultation and experience in the EU.

## **Phase 3 Ad-hoc technical assistance**

The study team will deliver continuous technical support to DG GROW on a stand-by basis to address questions raised by the Commission (e.g., by DG GROW, other DGs) and the Consultation Forum.

# Presentation of the Delivery Plan – Deliverables





**Any questions?**

# Study status

- Feedback from Phase 1 Draft report has been received.
  - This will allow for the in-depth review of our Phase 1 draft report and recommendations.
- The quantitative questionnaire has been sent out in early December.
  - This detailed data is to ensure that we can model impacts from regulatory changes in Phase 2.
  - For market information, we would like your insight into the EU market as a whole, not the proprietary data of each stakeholder.
  - We can sign NDAs to reassure stakeholders that data will be protected and anonymised in our research.
  - Deadline is for the 24th of January 2024

**Thank you** to stakeholders for the very strong engagement and contributions.



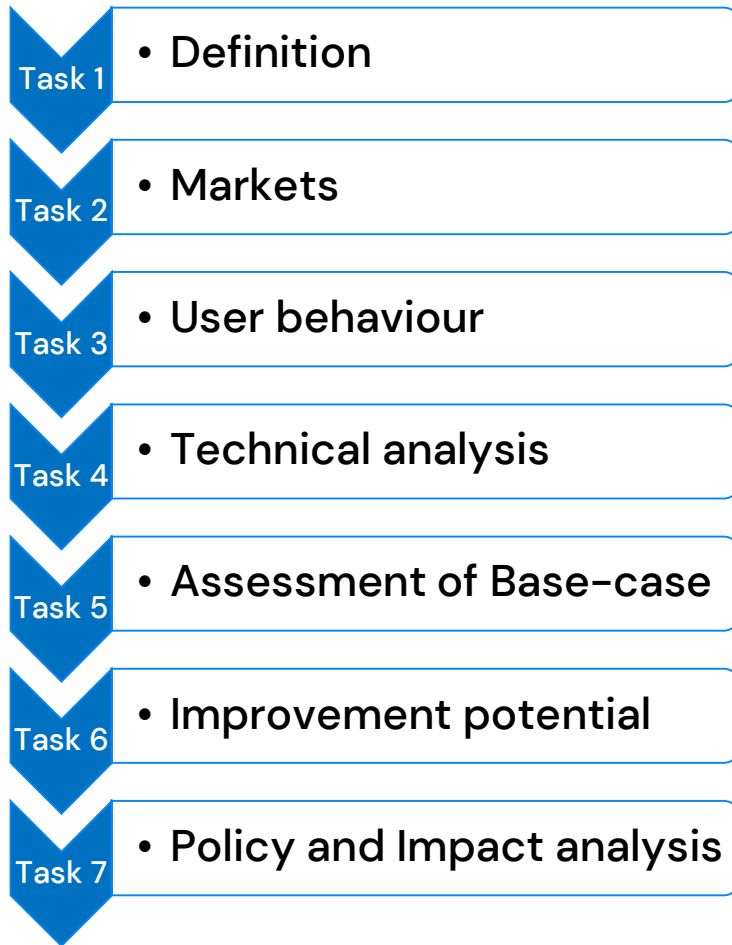


## Phase 2 Overview

## Phase 2 overview structure

### Phase 2- Update of the preparatory study for the transformers Regulation

This phase will update the existing preparatory study of Commission Regulation (EU) 2019/1783, informed by Phase 1, and further by additional market research, consultation and experience in the EU.



# Focus sections for Phase 2 report

## Task 1

- **Definition**
- Covering General context, product definition, measurement and test standards and existing legislation
- ICF to also refer to Phase 1 inputs for:
  - the functional categorization under dry and liquid type transformers
  - the PEI test methodology

## Task 2

- **Economic and market analysis**
- Covering Economic data, market channels, market trends and user expenditure base data
- ICF to also refer to Phase 1 inputs for:
  - the impact of renewable energy integration and electricity prices
- Additionally containing sections:
  - to review of disproportionate costs mechanisms
  - on the supply chain of amorphous steel
  - Small industrial transformer end-user prices

## Focus sections for Phase 2 report

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### Task 3

- **User behaviour**
- Covering use phase impacts, maintenance, repairability, end-of-life, and system considerations
- Additionally containing sections:
  - Review of the exemption on offshore applications
  - Review of the exemption on pole-mounted transformers
  - Review of special combinations of winding voltages for medium power
    - Including quantifying the market share, and an estimate of voltage switching benefits.

### Task 4

- **Technical Analysis**
- Covering the technical product descriptions, standard improvements and best available technologies
- Covering production bill of materials, distribution and end-of-life

## Focus sections for Phase 2 report

### Task 5

- **Assessment of Base-case**
- Covering the definition of our base cases, determining the inputs for the base cases (energy use, materials, lifecycle, etc.), determining an environmental impact assessment, life cycle costs and EU totals.
- Additionally containing sections:
  - The total cost of ownership for the base cases considered

### Task 6

- **Improvement Potential**
- Covering the identification of design options, the assessment of the environmental impacts, life cycle costs and purchase price for the Base Cases. This includes a review of the Lowest Life Cycle Costs and the Best Available Technology.
- Design options to include:
  - A low-level PEI on small transformers
  - An increase of product lifespan through reparability measures
  - The recovery and regeneration of oil

### Task 7

- **Policy and impact analysis**
- Cover the proposed measures, run scenario analysis on resource use, environmental impact and socio-economic impacts, perform sensitivity analysis

## Base cases for Analysis in Phase 2 report

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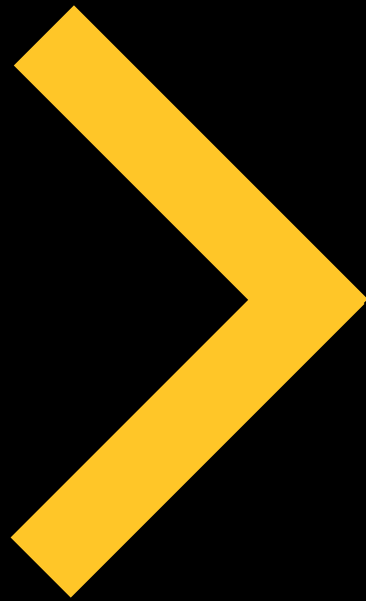
### Base Case 1: Distribution Transformer

Rated power of each winding: 400 kVA  
Number of Phases: 3  
Liquid immersed  
Regulation voltage levels high side:  
<=24kV  
No Load Losses (P0): 387 W  
Load Losses (Pk): 3250 W  
Impedance: 4%

### Base Case 2: Small transformers including Separation/Isolation Transformer

Rated power of each winding: 16 kVA  
Number of Phases:3  
Dry-type  
Regulation voltage levels high side: <=1.1kV  
No Load Losses (P0): 110 W  
Load Losses (Pk): 750 W  
PEI: 96.4%  
Impedance: 6%

- Please provide feedback in the Quantitative Questionnaire on the Base cases chosen.



**Any questions?**



Phase 1 draft report:  
Technical Analysis – Article 7 of  
Regulation 2019/1783



# Overview of review items

## Items listed in Article 7 of Regulation 2019/1783:

- a) the extent to which requirements set out for Tier 2 have been cost-effective and the appropriateness to introduce stricter Tier 3 requirements;
- b) the appropriateness of the concessions introduced for medium and large power transformers in cases where installation costs would have been disproportionate. In particular, the analysis should investigate concessions in concrete cases (e.g. manufacturers, electricity companies, market surveillance authorities) and determine their appropriateness;
- c) the possibility of utilising the PEI calculation for losses alongside the losses in absolute values for medium power transformers;
- d) the possibility to adopt a technology-neutral approach to the minimum requirements set out for liquid-immersed, dry-type and, possibly, electronic transformers;
- e) the appropriateness of setting minimum performance requirements for small power transformers;
- f) the appropriateness of the exemptions for transformers in offshore applications;
- g) the appropriateness of the concessions for pole-mounted transformers and for special combinations of winding voltages for medium power transformers;
- h) the possibility and appropriateness of covering environmental impacts other than energy in the use phase, such as noise and material efficiency

## Further items to be analysed:

- i) material efficiency aspects;
- j) an analysis of the standards, and of their relevance for regulatory purposes;
- k) technological, market and regulatory evolutions affecting environmental performance;
- l) ecodesign (or similar) requirements for power transformers in other jurisdictions, in particular the US and Japan and in comparison to current ecodesign requirements for Tier 2.
- m) strengthening potential of the existing MEPS and the potential of introducing material efficiency requirements(MMPS);
- n) impact of rising electricity prices on current and potentially stricter ecodesign requirements.
- o) existing methodologies for assessing technoeconomic aspects of ecodesign for power transformers (especially in terms of technology neutrality, circularity, MEPS and MMPS), as well as for the assessment of the costs for replacement/installation of transformers, based on the principles laid down in Regulation 2019/17834.
- p) functional categorisation of power transformers (including conventional transformers, overload transformers and fire performant transformers and any others that the contractor may suggest).
- q) a techno-economic analysis on the relevance and feasibility of requirements (in particular for low-to-medium and medium-to-high voltage transformers) related to design features aimed to increase the efficiency and lifetime of transformers when working with reversed power flows (due, for instance, to electricity from renewable energy sources injected in the grid at lower voltage levels).
- r) other topics, as emerged from consultations with stakeholders.

# Methodology

- Consultation with stakeholders
  - Stakeholder meeting
  - Qualitative questionnaire (32 responses)
- 1-1 calls
- ICF expertise

To answer the queries set out in Phase 1, the research team consulted with stakeholders through the first stakeholder meeting and qualitative questionnaires, and direct 1-to-1 calls.

From this feedback, along with ICF's expertise, the items a) to r) were answered.

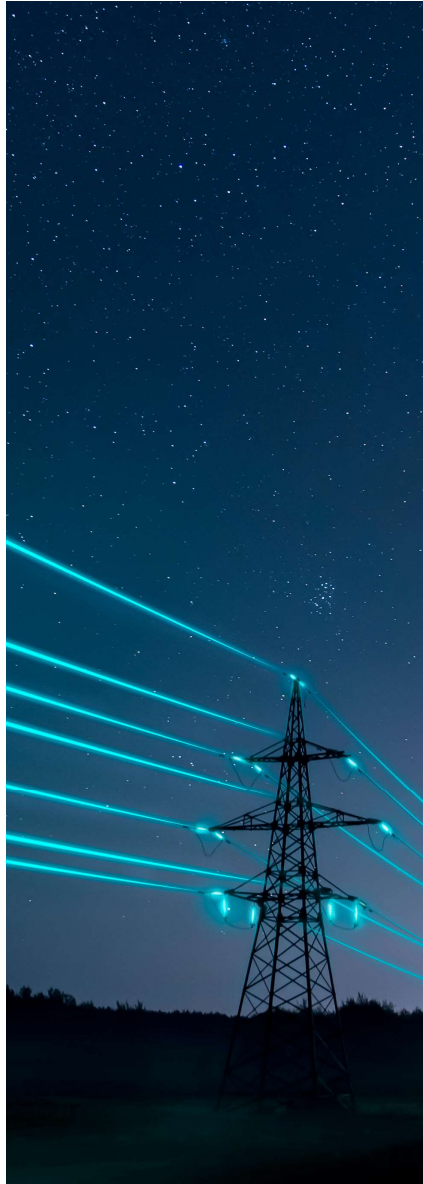
For each theme, the report details the background to be aware of in the theme, develops the stakeholder feedback and research results, makes draft recommendations to policymakers on next steps for Ecodesign and sets out in which sections of the Ecodesign preparatory study will be updated (phase 2).

This presentation focuses on the draft recommendations only.

## Existing standards and regulations

j) An analysis of the standards, and their relevance for regulatory purposes;

l) Ecodesign (or similar) requirements for power transformers in other jurisdictions, in particular the US and Japan, and in comparison to current Ecodesign requirements Tier 2.



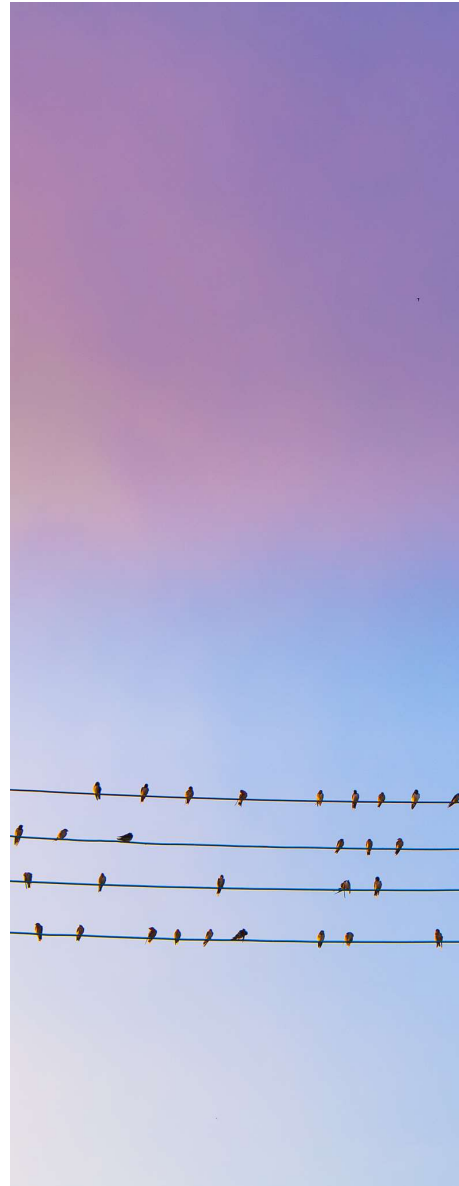
- The IEC 60076 standard is the most commonly used, which has been harmonized by CENELEC.
- EN 50708 was developed by CENELEC as a further requirement. Recommend continuing to **align with the EN 50708** standard.
- However, as the standards are revised, must ensure that definitions of small, medium and large transformers does not change the regulatory scope.
- **EU Tier 2 competes strongly** with Japan and US regulations.

## Ecodesign energy efficiency requirements

a) The extent to which requirements set out for Tier 2 have been cost-effective and the appropriateness to introduce stricter Tier 3 requirements.

e) The appropriateness of setting minimum performance requirements for small power transformers

n) Impact of rising electricity prices on current and potentially stricter Ecodesign requirements.



- To review **the TCO for raising Tier 3** under the Phase 2.
- Also consider the concerns with regards to the **amorphous steel supply chain**.
  - Please provide feedback with regards to the supply chain of amorphous steel.
- Consider the potential for **a conservative PEI requirement on small transformers**. To be modelled under Phase 2 Base case models.
  - Please provide performance indications on the small power transformers.
- Total Cost Ownership concerns for transformers are mostly on the material costs, due to the lifetime of the asset, the short-term variability of **electricity prices are of minimal concern**.

## Implementation of Ecodesign requirements and methodologies (1/3)

b) the appropriateness of the concessions introduced for medium and large power transformers in cases where installation costs would have been disproportionate. In particular, the analysis should investigate concessions in concrete cases (e.g. manufacturers, electricity companies, market surveillance authorities) and determine their appropriateness;



- Recommendation to **keep the concession for "disproportionate costs"** for cases where the 1-to-1 replacement is not possible.
  - Phase 2 to engage with MSAs to **clarify the mechanism for the concession.**
    - This clarification is needed to ensure that stakeholders can use the existing regulatory exemption.
    - We currently have **had no written evidence** of the successful use of this mechanism.

## Implementation of Ecodesign requirements and methodologies (2/3)

c) the possibility of utilising the PEI calculation for losses alongside the losses in absolute values for medium power transformers;

o) existing methodologies for assessing technoeconomic aspects of Ecodesign for power transformers (especially in terms of technology neutrality, circularity, MEPS and MMPS), as well as for the assessment of the costs for replacement/installation of transformers, based on the principles laid down in Regulation 2019/1783;



- Medium transformers represent the largest market share of transformers and hence affect grid losses significantly.
- Recommendation to **keep the absolute values of losses for medium transformers without PEI.**
- **Phase 2** will include a **review of TCO of the base cases** modelled, which will include material concerns such as increased lifetime and recycling considerations.

## Implementation of Ecodesign requirements and methodologies (3/3)

q) a techno-economic analysis on the relevance and feasibility of requirements (in particular for low-to-medium and medium-to-high voltage transformers) related to design features aimed to increase the efficiency and lifetime of transformers when working with reversed power flows (due, for instance, to electricity from renewable energy sources injected in the grid at lower voltage levels).

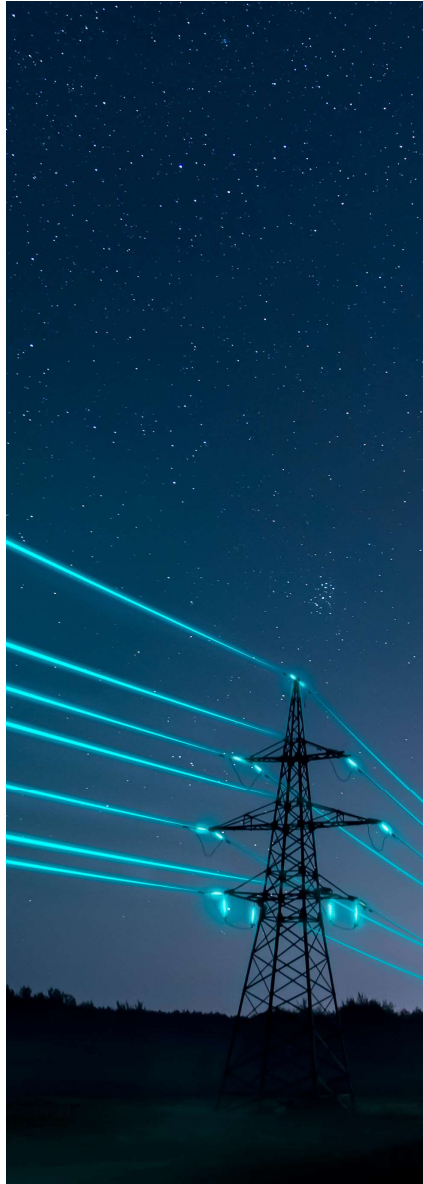


- Specific **Reverse Power Flow transformers should be defined for manufacturers** to accommodate appropriate protection and control systems, for safe and reliant operation. This is **an action for technical standards body**.
  - For context, stakeholders are asked to feedback the number of cases where specific reverse power flow transformers requirements are installed.

## Regulation definitions and scope (1/2)

f) The appropriateness of the exemptions for transformers in offshore applications;

g) The appropriateness of the concessions for pole-mounted transformers and for special combinations of winding voltages for medium power transformers;



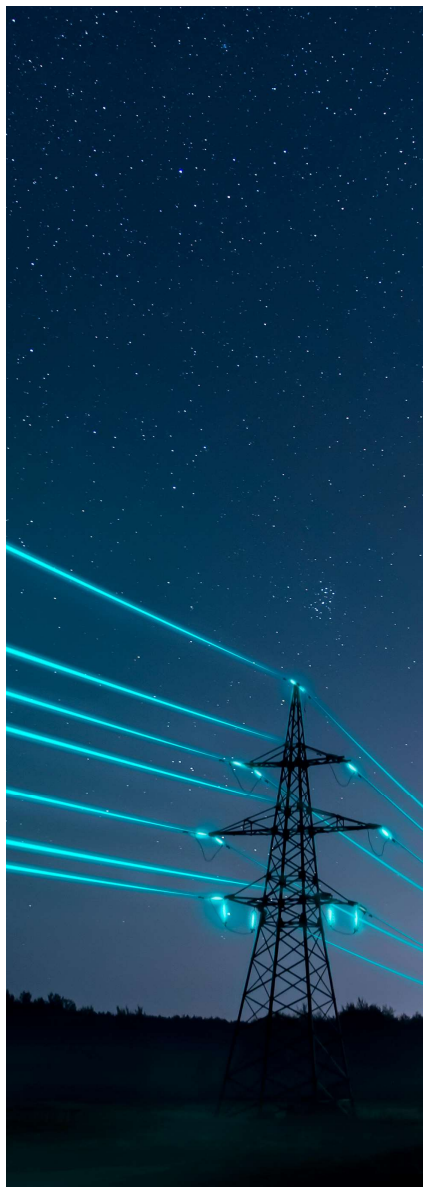
- As **offshore** applications are a non-negligible share of the market, with strong growth, these are recommended to **be brought back into the regulation**.
  - More data is sought on offshore applications via the quantitative questionnaire.
- **Pole mounted transformers** are recommended to have their concessions removed from the regulation.
- The concession for the **combination of winding voltages** requires **review under Phase 2** to justify the concession from Tier 2 to Tier 1.
- For all of the above cases, the **exemption under the disproportionate costs mechanism** could be used to justify performance changes.
  - This brings in focus the need for review of the mechanism under Phase 2.



## Regulation definitions and scope (2/2)

d) the possibility to adopt a technology-neutral approach to the minimum requirements set out for liquid-immersed, dry-type and, possibly, electronic transformers;

p) Functional categorisation of power transformers (including conventional transformers, overload transformers and fire performant transformers)

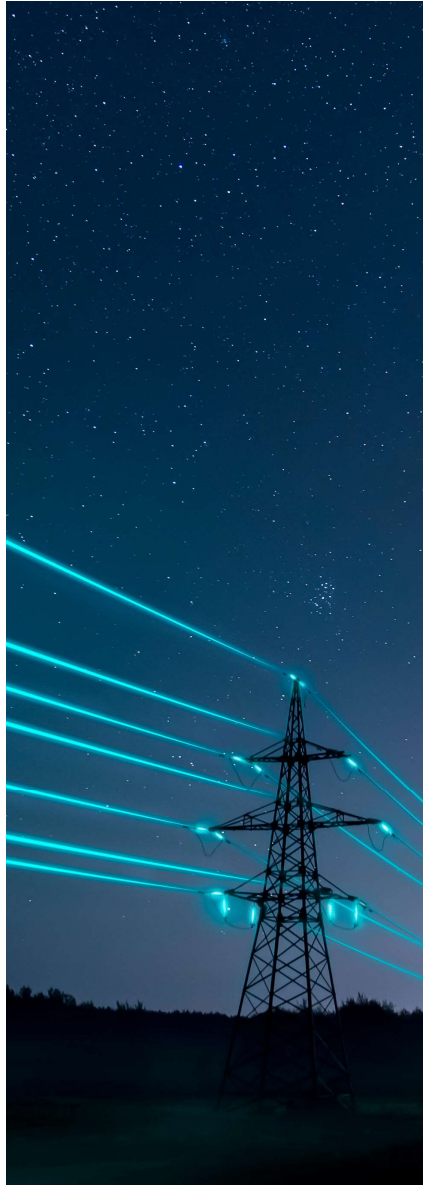


- There **is little appetite** from stakeholders to have **functional categorisation of transformers**. Transformers are currently classified under a dry or liquid immersed categorisation.
- Ecodesign should **only follow** a functional, technology-neutral approach **if standard IEC 60076 were to create those framework definitions**. This would lead Ecodesign to rename performance requirement tables under the new standard definitions. This is **not expected to change performance requirements** but may allow for other transformer technologies to enter the market.

## Material efficiency

i) Material efficiency aspects;

m) Strengthening potential of the existing MEPS and the potential of introducing material efficiency requirements (MMPS)

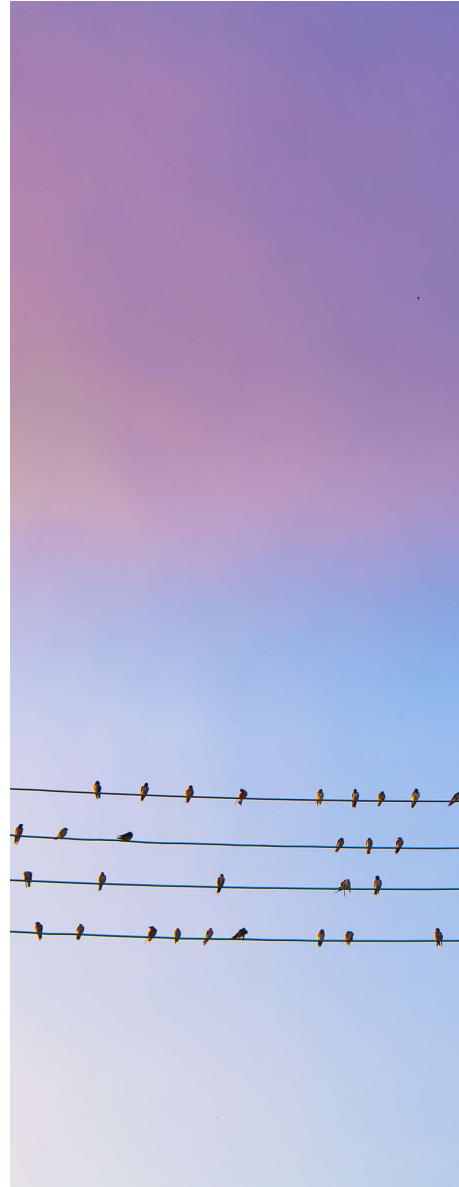


- Phase 2 will review the potential benefits of **disassembly requirements to allow for repair**. Base Case modelling will determine the impacts of **lifetime extension**.
- Phase 2 will **review the implementation of the article 1.3** to determine common practice and responsibilities of the repair process.
  - This will inform recommendations on potential changes to article 1.3
  - Stakeholders are invited to provide insight into current practices.
- The **benefits of recovery and regeneration of mineral oil** will be included under Phase 2 modelling.

## Environmental considerations

h) the possibility and appropriateness of covering environmental impacts other than energy in the use phase, such as noise and material efficiency.

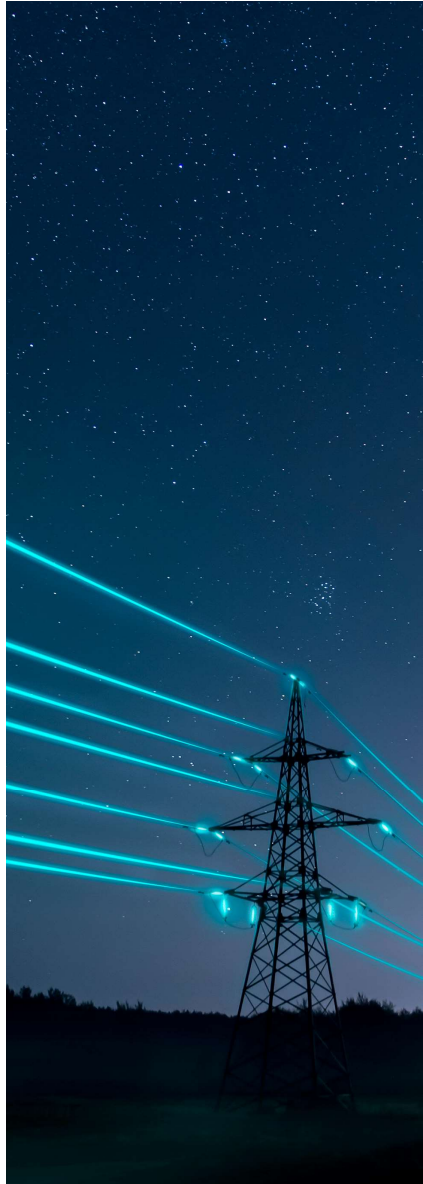
k) technological, market and regulatory evolutions affecting environmental performance;



- It is recommended that Ecodesign **not include a requirement regarding transformer noise**, but rather leave these to existing national and local governments.
- It is recommended for **transformer operating and storage temperature range** be made a provision requirement.

## Other Topics

r) other topics, as emerged from consultations with stakeholders.



- It is recommended that **Ecodesign not include a requirement to regulate SF6** as these are covered by other regulations.
- It is recommended **Ecodesign not set their own test methodology for determining kPEI**. CENELEC has been engaged in reviewing this methodology for Ecodesign to align with.
- It is recommended that **Ecodesign regulation not consider the use of sustainable peak load** until a standard for the metric has been developed.

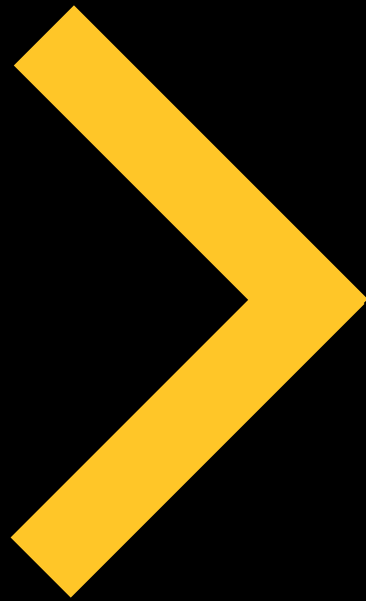


Next steps

# Stakeholder feedback

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- Phase 1 draft report was published in December, thank you for the feedback submitted
- Quantitative questionnaire was set out in December. This is organised to provide feedback on data regarding performance, materials and market.
- Signposts have been set to orient stakeholders towards questions of most interest for them.
- Completion deadline is 24<sup>th</sup> of January.
- These can all be found here: <https://eco-transformers-review.eu/documents/>
- Please send completed responses to [transformersreview@icf.com](mailto:transformersreview@icf.com)



**AOB**

→ Thank you


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for your participation

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Get in touch with us:  
Transformers Study Review  
[transformersreview@icf.com](mailto:transformersreview@icf.com)



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