DG ENER Lot 2 Transformers review: comments on the draft study report

May 2017

Following the stakeholder meeting on 29 March 2017 in Brussels, we have identified a list of issues that the study team should carefully assess in their review study, for the Commission to be able to make a sound decision in the later stages of the process.

Market risks and changes suggest that single phase transformers should be subject to efficiency requirements

The current regulation does not set any efficiency requirements for single phase transformers, though these are subject to information requirements. To date, it has been argued that single phase transformers are solely an issue for the UK and Ireland, but market changes may alter this. There are compelling reasons why this regulatory review process must carefully assess the appropriateness of setting efficiency requirements on single phase transformers:

- Smaller and single phase transformers are exactly the type of product intended to be addressed by ecodesign measures: mass produced in large numbers, significant scope to reduce impact and market failure to incentivise deployment of the better models (cost pressures and little knowledge or interest of buyers in the technical specifications).
- Given that major economies including Australia, Canada, China, Japan, Korea, Mexico and the USA are regulating the efficiency of single phase transformers, EU risks becoming a global dumping ground for poor quality, low cost single-phase transformers as standards rise elsewhere.
- Our understanding is that sales of single phase isolation transformers are likely to grow significantly as Electric Vehicle fast-charging (DC) stations are deployed across the EU[1], with a 30% compound annual growth rate (CAGR) from 2016 to 2022, when the overall market for electric vehicle chargers is anticipated to be a USD 12 Billion industry (MarketsandMarkets); there are 115,000 charging stations across EU in 2017 (European Alternative Fuels Observatory) but there will be 1,000,000 by 2025 (Transport & Environment).
- As noted in the draft Preparatory Review Study: "*it should be cost effective to impose Ecodesign limits on the **no load** losses of single phase transformers up to at least the threshold associated with the AAAo class indicated in the EN50588 standard*" (page 55). Also noting that: "*there is likely to be little or no economic justification to set Ecodesign **load** loss limits for single phase transformers*" (page 59), although the accuracy of this conclusion must also be checked against their future market uses, which could be quite different to currently.

[1] Our understanding is that transformers are needed for fast-charging (DC,'Mode 4') solutions, wherever fast turnaround is needed such as for bus depots, some office installations etc; transformers are not generally required for slow charge solutions such as in homes.

⇨ **We therefore suggest that the study team takes the following actions:**

- Ideally, complete an assessment of how major market changes, such as explosive growth of electric vehicle chargers over the coming decade, will impact the importance of this product sub-group and make it relevant across more of the EU than just UK and Ireland.
  Alternatively, should the timing and budget of the review study not allow for this assessment, we suggest that the study team collects input from stakeholders, including those who attended the meeting and offered to provide data, and reflect the intelligence gathered in the final report.
- Ensure that the review study evaluates whether Tier 2 requirements should be applied to single-phase transformers and what the potential impact would be (i.e. complete section 2.4 page 59).
- The current exemption for "*transformers with low-voltage windings specifically designed for use with rectifiers to provide a DC supply*" must be reconsidered in light of future market growth in this direction.

EU efficiency requirements for medium power transformers at the lower end of the power rating regulatory scope are weak compared with all other economies. These should be subject to effective efficiency and information requirements.

There are two significant problems with the current treatment of medium power transformers at the lower end of the power rating scope under the existing Regulation which leave EU buyers unaware of the energy efficiency penalty that they are paying, compared with all other regulated economies, and this poses another area of risk of the EU being a dumping ground for poor performing products:

- Firstly, the efficiency levels required for lower power ratings (below 50 kVA for liquid-filled and below 100 kVA for dry-type) are significantly poorer than the standards set by other major economies such as Australia, Japan, Korea and the USA. The reasons for this stark difference, as illustrated in Figure 1 below, are worth understanding: requirements in these other economies are based on the strong evidence of physics and economics of transformer design and manufacture, and result in a '0.75 scaling rule'[2] being applied to generate suitable efficiency requirements for smaller transformers; whereas, the EU requirements are strongly influenced by characteristics of the established market and its retention;
- Secondly, due to the use of the less than or equal to sign ("≤") in the table of the maximum losses, the lowest end of the power rating scope for medium power transformers and for pole-mounted that are liquid filled, all those of 25 kVA rated power and less are subject to the same absolute values of load losses and no-load losses. The consequence is that the *efficiency* levels required to meet them fall precipitously as rated power approaches the lower limit of the regulatory scope at 1 kVA. (As noted firstly, this is a fall from the levels already much lower than those set for other economies between 25 kVA and 50 kVA). The same situation exists for dry-type of less than 50 kVA.

[2] The '0.75 scaling rule' states that for similarly designed transformers, construction costs and watt losses scale to the ratio of kVA ratings raised to the 0.75 power. As notified to US DOE by Square D during a public hearing about the Department's test procedure rulemaking held on January 6, 1999, and later confirmed by other US DOE research.

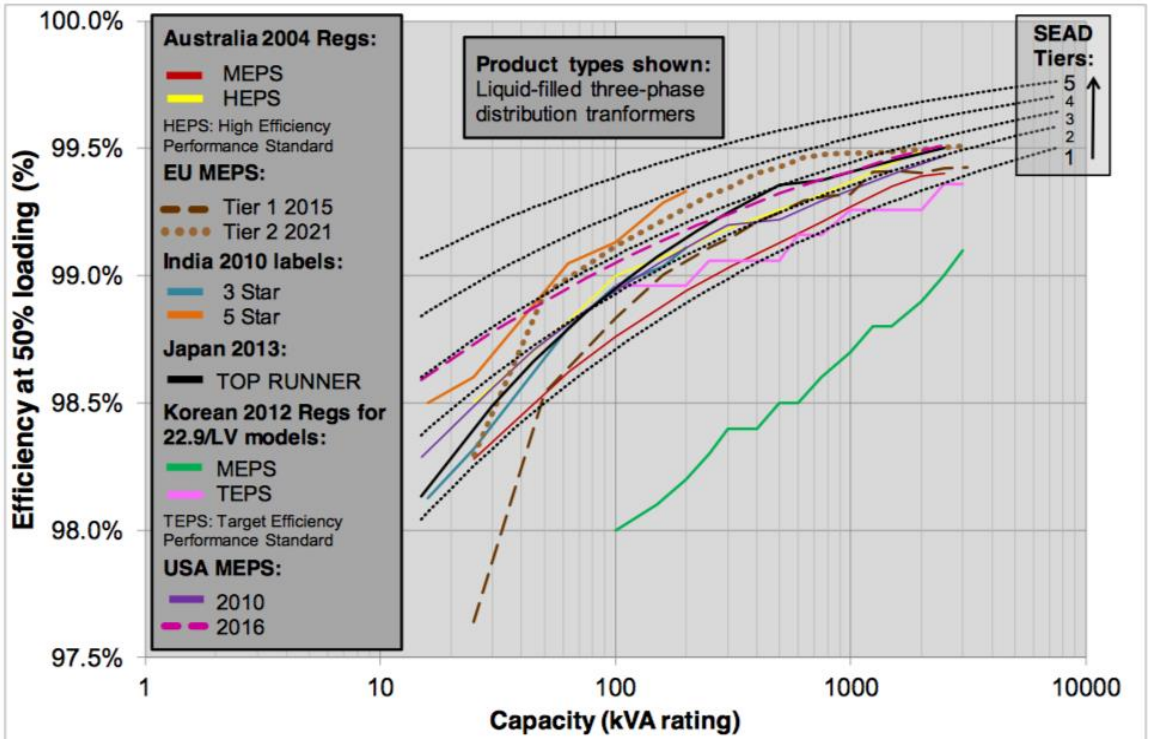

Figure 1. Comparison of MEPS for liquid-filled 3-phase transformers for Australia, the EU, India, Japan, Korea and the USA, also showing the internationally recognised performance tiers that were published by SEAD and later included in Annex B of IEC TS 60076-20 (Edition 1.0, 2017).
Source: Benchmarking report for distribution transformers, IEA 4E, May 2014, Figure 29.

⇨ **We therefore recommend the following actions:**

- Complete the table so that maximum load losses and no-load losses are defined for the lowest covered rated power category, i.e. scale and set losses using the '0.75 scaling rule' at 5kVA or 10kVA where appropriate and remove the less than or equal to sign. Establish clear and prominent energy efficiency or loss level categories (as easily understood as energy label classes) to ensure that buyers of 'commodity' units (specified with less technical insight or detail) understand the relative energy efficiency of alternative products. Tiers of energy efficiency as defined in Annex B of IEC TS 60076-20:2017 *Power transformers - Part 20: Energy efficiency*[3] could be appropriate. Such label classes would enable other policies to advance the market such as incentive schemes/rebates/white certificates for buying above the regulatory minimum.

Small power transformers should be subject to effective efficiency requirements

A 'Small power transformer' is defined in the Regulation as '*a power transformer with a highest voltage for equipment not exceeding 1.1 kV*'. These include some single-phase transformers and all (over 1 kVA rated power) are within scope of the regulation. But small power transformers are not subject to any efficiency requirement, only to information requirements. As with single phase transformers, there are compelling reasons why this regulatory review process must carefully assess

[3] https://webstore.iec.ch/publication/28063&preview=1.

the appropriateness of efficiency requirements for small power transformers. Such an assessment is also required under the regulatory review clause (Article 7) and yet the Review Study team has not yet addressed them and wrongly indicated on the 29 March that no test standard exists. The reasons to address small power transformers are:

- Sales of small power transformers are likely to grow significantly as Electric Vehicle fast-charging (DC) stations are deployed across the EU[4], see statistics already mentioned under single phase transformers above;
- A new standard, prEN50645 "Ecodesign requirements for small power transformers"[5] will be published in 2017 (in response to Mandate M/495) and our understanding is that this sets out a form of energy label class system based on no-load losses for 3-phase transformers of less than 1.1 kV power rating (it does not address load losses). This makes possible much clearer differentiation of performance and opens the possibility of effective efficiency requirements for such units.

⇨ **We therefore suggest that the study team investigates how the efficiency classes defined in EN50645 could help setting requirements on these units.**

Wide availability of fire-safe alternatives to mineral oil-filled transformers means that the concessions allowed for dry-type transformers must be re-evaluated

Dry-type transformers are subject to less stringent requirements, despite performing an identical function to that of liquid-filled transformers. Historically, this was to ensure market availability of units that are fire-safe, since dry-type cannot match the lower losses of liquid-filled units. However, high temperature fire-safe fluids are now widely available, including ester oils and silicone fluids. In the same way that Ecodesign has helped to shift lighting from incandescent lamps to LEDs, a phased reduction in concessions for dry-type transformers will grow the fire-safe liquid-filled market and ensure a much better and economically viable solution. The advantages of liquid-filled transformers include higher efficiency, longer service life, easier to recycle, quieter operation, smaller size / volume (particularly important for brown-field sites). Tier 3 should therefore be used to help move the EU market in this direction and, in so doing, stimulate EU businesses to take a lead to meet future global demand through EU technologies and EU jobs. This will increase user choice and facilitate the market for compact transformers, which is important to address brownfield site constraints.

⇨ **We therefore urge the study team to put forward policy scenarios that would make all units subject to the same liquid-filled thresholds and assess their impacts.**

Review concessions for 'unusual windings'

Review of Table I3 of the regulation was an important requirement of the review study (section 3.3), but this was not done in the draft report, nor was it discussed at the workshop of 29 March as

[4] Our understanding is that transformers are needed for fast-charging (DC, or 'Mode 4') solutions, wherever fast turnaround is needed such as for bus depots, some office installations etc; transformers are not generally required for slow charge solutions such as in homes.

[5] CENELEC is expected to approve and publish a new European Standard setting out 'Ecodesign requirements for small power transformers' (EN 50645), which is being prepared by a Taskforce of the CENELEC Technical Board (CLC/BTTF 146-1) in response to a request from the European Commission (M/495 Am.2).

promised. The allowances of 10%, 15% and 20% are too generous and lack supporting data for their justification.

⇨ **Any such data should be published for review before the concessions are considered for retention.**

Other issues to be considered

- **Give resource efficiency aspects sufficient attention**

In the Working Plan 2016-2019, the EU has taken a strong commitment to establish product-specific requirements to make products more durable, reparable, upgradeable, and designed for disassembly, reuse or recycling. This commitment also applies to the ongoing review and resource efficiency aspects need to be seriously looked at. In particular, we think that additional work should take place regarding the **environmental impacts of alternative liquids to mineral oils**.

- **Significantly reduce the scope for brown-field exemptions to the requirements**

Far from reducing exemptions, the study has so far only proposed additional exemptions (e.g. for very large green field transformers that could be subject to transport restrictions). Brown field sites account for 90% of transformer installations and the market for compact transformers has grown, with further technology opportunities to be exploited. In addition, commodity prices have fallen, making higher efficiency even more easily justified in many applications. The current exemptions should only be retained if justified under a fresh evaluation of anticipated future market conditions, bearing in mind the very long product life. And for exemptions that are agreed to be retained, we support the suggestion to impose at least the maximum specific core losses, as suggested in the review study.

- **Phase out the concessional allowances for pole-mounted transformers**

Concessions regard the weight limits for pole mounted transformers that are used to restrict efficiency limits. Such a distinction is not used or considered necessary, for example, in US regulations and EU concessions are based on very old technologies. Regulation 548/2014 does not specify the type of pole construction but this is important. At the very least, maximum specific core losses should be considered, but options to extend coverage of ecodesign requirements to pole mounting *systems* must be properly evaluated, which could require capacity for future upgrade to be built in at first installation, i.e. to install dual poles capable of taking larger loads at future upgrade. ECOS supports the phasing out of lower ambition allowances for pole mounted transformers.

- **Assess proposed options for Tier 3**

We support the further examination of the refining options for Tier 3, including adding a minimum kPEI for large power transformers, reduced no load losses e.g. A0-10%, extend scope to substations and mounting-poles (facility provisions) covering minimum dimensions and weights characteristics - to avoid lock-in of transformer types.

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