Texte zu EU-Regelungen zur umweltgerechten Produktgestaltung und zur Energieverbrauchskennzeichnung in der Beleuchtung – Zusammenstellung [1] des Umweltbundesamtes (UBA), Deutschland

1194/2012/EU
874/2012/EU
245/2009/EG
§
2019/2020/EU
2019/2015/EU
244/2009/EG

Diskussion über künftige Änderungsverordnungen (Produktgestaltung und -information)

Diskussionstext der EU-Kommission vom 10. Juni 2020: **Stellungnahme von Prof. Sven Linow, Hochschule Darmstadt [2] vom 30. Juni 2020**

Hinweis: Bitte beachten Sie, daß der angehängte Text nur in Englisch verfaßt ist.

EN: Information on EU Lighting Regulations – Ecodesign and Energy Labelling – Compilation [1] of the Federal Environment Agency (UBA), Germany

Discussion of future amending regulations (Product Design and Product Information)

The EU Commission's discussion text as of 10 June 2020: Comments of Prof. Sven Linow, University of applied sciences Darmstadt [2] as of 30 June2020

FR: Informations sur réglementations de l'UE concernant l'éclairage – l'écoconception et l'étiquetage énergétique – Compilation [1] de l'Agence Fédérale de l'Environnement (UBA), Allemagne

Discussion sur les futurs règlements modificatifs (Conception des produits et informations relatives aux produits)

Texte de discussion de la Commission européenne du 10 juin 2020 : Commentaires du Prof. Sven Linow, haute école spécialisée Darmstadt [2] du 29 juin 2020

Indication : Veuillez noter que le présent texte n'est disponible qu'en anglais.

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[1] https://www.eup-network.de/de/eup-netzwerk-deutschland/offenes-forum-eu-regelungen-beleuchtung/dokumente/texte/

[2] https://fbmk.h-da.de/fachbereich/personen/professorinnen-und-professoren/sven-linow/

DE: ↓ EN: → page III FR : → page IV

Texte im Offenen Forum (**abc** = vorliegender Text)

- **Bestehende EG- und EU-Regelungen**
- **Studien der EU-Kommission**
- **Regelungsentwürfe**
  - Frühere Entwürfe
  - **Änderungsverordnungen**
    - Vorab-Stellungnahmen, Hintergrundinformationen und Diskussionstexte
    - Informelles Interessensgruppentreffen am 19. Februar 2020
    - EK-Entwürfe vom Mai 2020 (Produktgestaltung und -information)
    - Konsultationsforum (4. Juni 2020)
    - **EK-Entwürfe vom Juni 2020 (Produktgestaltung und -information)**
      - Texte der EU-Kommission (10. Juni 2020)
      - Arbeitshilfen/Diskussionstexte
      - **Stellungnahmen**
        - Mitgliedstaaten
        - **Andere Interessensvertretungen**
          - **Prof. Linow, Hochschule Darmstadt, DE (30. Juni 2020) [EN]**
          - Andere: ◦ Herstellerverband Lighting Europe ◦ Unterhaltungssektor ◦ Umweltorganisationen
- **Öffentliche Konsultationen auf EU-Ebene**
- **Diskussion im Offenen Forum**
- **Weitere Dokumente**

Abkürzungen: ● EG = Europäische Gemeinschaft ● EK = EU-Kommission ● EU = Europäische Union

EN

Documents in the Open Forum

(**abc** = text at hand)

- **Existing EC and EU Regulations**
- **Studies of the European Commission**
- **Draft regulations**
  - Earlier drafts
  - **Amending Regulations**
    - Comments in advance, background information and discussion texts
    - Informal stakeholder meeting on 19 February 2020
    - EU Commission’s drafts of May 2020 (Product design and information)
    - Consultation Forum (4 June 2020)
    - **EU Commission’s drafts of June 2020 (Product design and information)**
      - Texts of the EU Commission (10 June 2020)
      - Working aids/Discussion texts
      - **Comments**
        - Member States
        - **Other interested parties**
          - Manufacturer association Lighting Europe
          - **Prof. Linow, University of applied sciences Darmstadt, DE (30 June 2020) [EN]**
          - Others: ◦ Manufacturer association Lighting Europe ◦ Entertainment sector ◦ Environmental organisations
- **Public Consultations at EU level**
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Abbreviations: ● EC = European Communities ● EU = European Union

FR

Documents dans le forum ouvert

(**abc** = présent document)

- **Règlements existants de la CE et de l'EU**
- **Études de la Commission européenne**
- **Projets de règlements**
  - Projets antérieurs
  - **Règlements modificatifs**
    - Commentaires en avance, informations de fond et textes de discussion
    - Réunion informelle des parties prenantes le 19 février 2020
    - Projets de la Commission européenne du mai 2020 (Conception des produits et informations sur les produits)
    - Forum consultatif (4 juin 2020)
    - **Projets de la Commission européenne du juin 2020 (Conception des produits et informations sur les produits)**
      - Textes de la Commission européenne (10 juin 2020)
      - Aides du travail/Textes de discussion
      - **Commentaires**
        - États membres
        - **Autres groupes d'intérêt**
          - **Prof. Linow, haute école spécialisée Darmstadt, DE (30 juin 2020) [EN]**
          - Autres : ◦ Association de producteurs Lighting Europe ◦ Secteur du divertissement ◦ Organisations environnementales
- **Consultations publiques au niveau de l'UE**
- **Discussion dans le Forum Ouvert**
- **Autres documents**

Abréviations : ● CE = Communauté européenne ● UE = Union européenne

Es folgt ein unveränderter Originaltext.

EN: The following is an unmodified original text.

FR: Ce qui suit est un texte original.

Comments of proposed changes to Commission Regulations (EU) 2019/2015 and (EU) 2019/2020 on requirements and labelling for light sources

Respectfully submitted by

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Summary

This assessment provides a perspective from the infrared electroheating industries viewpoint. It focuses on the intersection between energy efficiency in lighting vs. in infrared electroheating.

The proposed change to the (EU) 2019/2020, ANNEX III point 3. s) is supported by this assessment and supporting arguments are provided:

> *Incandescent light sources with blade contact-, metal lug-, cable-, litz wire-, pin base-, metric thread- or non-standard customised electrical interface, encasing made from quartz-glass tubes, specifically designed and marketed for industrial or professional electro-heating equipment (e.g. stretch blow-moulding process in PET-Industry, 3D-printing, photovoltaic and electronic manufacturing*

The proposed addition of a recital in (EU) 2019/2015 is supported by this assessment. Arguments are provided which support a minor addition to the proposed text, as robust calculation methods exist:

> *The relevant product parameters should be measured or calculated using reliable, accurate and reproducible methods. Those methods should take into account recognised state-of-the-art measurement or calculation methods including, where available, harmonised standards adopted by the European standardisation bodies (…)*

To better align these two regulations, to support energy efficiency in infrared electroheating an extra exemption is proposed in (EU) 2019/2015 ANNEX IV Exemptions 3:

> *Incandescent light sources with blade contact-, metal lug-, cable-, litz wire-, pin base-, metric thread- or non-standard customised electrical interface, encasing made from quartz-glass tubes, specifically designed, marketed and used for industrial or professional electro-heating equipment (e.g. stretch blow-moulding process in PET-Industry, 3D-printing, photovoltaic and electronic manufacturing.*

Proposed Amendments to (EU) 2019/2020 on eco-design requirements

The issued Commission Regulation of 1 October 2019 is seen as a well-crafted complex document.

One major weakness identified during the drafting process and not solved with the issued regulations is the overlap between light sources (i.e. lamps intended to emit light for illumination) and infrared emitters for commercial and industrial use[1].

Lamps, or *light sources* as defined in Article 2 (1) of the draft belong to a larger class of devices intended to emit optical radiation for a purpose, where optical radiation is usually understood as the wavelength range between 200 nm and 1 cm. Light is a small part of this broad spectral range, but the only part being visible to the unaided human eye[2].

Radiation sources with the exception of dedicated light sources (lamps) are tools used in a plethora of technical and industrial processes where their intended radiation – which is quite often not visible light – is used. Such radiation sources are usually hidden in small scale or less well known manufacturing processes, in equipment used or manufactured by small- and medium sized enterprises (SMEs), in highly specialised machinery, in auxiliary processes, or in research and development. These highly specialised uses are indispensable for industry and governments. Industry can either use these processes in the EU or will offshore processes to other regions, that are affected or hindered by regulations[3].

ANNEX III 3., revision of exemption s) – incandescent emitters for industrial electroheating

Most issues have been resolved successfully during drafting of the regulations with the exception of emitters for infrared electroheating. The now proposed change to Annex III. Point 3(s) of the Regulation

> *"Incandescent light sources with blade contact-, metal lug-, cable-, litz wire-, pin base-, metric thread- or non-standard customised electrical interface, encasing made from quartz-glass tubes, specifically designed and marketed for industrial or professional electro-heating equipment (e.g. stretch blow-moulding process in PET-Industry, 3D-printing, photovoltaic and electronic manufacturing."*

will clarify this matter in a well-structured way and provide a good solution for the aims of the regulation as well as for keeping industry in the EU. Supporting arguments are:

a) Incandescent light sources are high-efficiency sources for infrared (optical) radiation. Nearly all consumed electricity is converted into infrared radiation (depending on equipment, but usually exceeding 90 %). This optical radiation is spread over a wide wavelength-range in the infrared. Often the complete spectrum can be used in heating processes (depending on the substrate heated in the process)[4]. No other radiation source matches the energy efficiency of incandescent infrared emitters.

b) Most infrared electro-heating processes are impossible to achieve with any other radiation source than incandescent emitters: IR LED have prohibitive costs and still many technical issues hindering their use; their energy efficiency is low with respect to the use phase and gets much lower if cumulated energy demand[5] of the necessary extra equipment is included. Gas-Infrared (i.e. generated by combusting fossil fuels) can't be used in any vacuum or with delicate surfaces.

c) The specific advantage or characteristic of incandescent emitters does not dependent on the type of the gas filling: The filling is usually a noble-gas, like Argon, Krypton, Xenon or a Vacuum. It can include additives like Halogens. The gas filling influences lifetime of the specific emitter.

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[1] Many documents issued at that time were highlighting this issue, including my "*Assessment of the future Commission Regulation laying down eco-design requirements for light sources and separate control gears (…)*" provided in November 2018.

[2] EN 60519-1: 2020, *Safety in installations for electroheating and electromagnetic processing – Part 1: General requirements*

This harmonised standard provides a classification

[3] Such offshoring will not contribute to climate aims or policies of the EU, as the emission of greenhouse gases will happen, just not inside the territory of the EU.

[4] EN 62798 ed. 1, *Industrial electroheating equipment – Test methods for infrared emitters*

[5] VDI 4600, *Cumulative energy demand (KEA) – Terms, definitions, methods of calculation*

d) Industrial use infrared emitters are characterised by an encasing (bulb or tube) made from quartz glass (including Vycor type glass): Quartz glass has the highest transparency for infrared radiation of all available glasses and can without any restrictions be used up to a temperature of about 900 °C. These technical advantages come at a higher cost and more complex manufacturing processes for emitters. Therefore, quartz glass as encasing material indicates in combination with the other properties given in the above proposal industrial use of infrared emitter.

e) Incandescent light sources shall not be used for general lighting (they show extremely low efficiency, as light is rather a by-effect of this type of radiation source). Therefore, any design that can easily be fitted into existing lamp sockets used for general lighting shall not be part of the exemption.

f) General lighting incandescent lamps were sometimes used as infrared emitters. Hindering their future use throughout will create some cost for some equipment affected: Safe electrical connections and improved geometries may become necessary. This is a small burden to businesses affected, but a minor nuisance compared to a ban of future use of electric infrared.

g) Incandescent emitters can include a halogen filling. Due to the complex chemistry of involved transport reactions halogen filling severely limits the design of such emitters. Low power rating, long unheated ends (necessary for vacuum or high temperature processes), some kinds of cycling are impossible to achieve. Therefore, *incandescent light sources (…) specifically designed and marketed for industrial or professional electro-heating equipment* are sometimes designed as halogen filled emitters and sometimes absolutely not. This is now well addressed in the proposal.

h) All emitters with open electric contacts (*blade contact-, metal lug-, cable-, litz wire*) must be installed by trained personnel[6]. They were never intended for use by the general public or laity. Even though some of the *pin base-, metric thread- or non-standard customised electrical interface* may provide some kind of protection, they usually shall be handled by instructed or trained personnel as well.

i) Industrial or professional electroheating equipment is marketed through specific channels not accessible for the general public. Manufacturers of such equipment have a high incentive to keep it this way and want to create technically sound solutions well adapted to specific processes, often resulting in including specialised optimally adapted infrared emitters manufactured in small numbers. The understanding of manufacturers is, that different processes need different technical solutions for best performance and efficiency. Such special purpose emitters tend to have power ratings and dimensions that effectively hinder their use outside industrial or professional equipment. This approach resulting in high energy efficiency is supported by the amended proposal.

j) Market dynamics press for ever cheaper solutions, over times introducing not well-adapted mass-marketed general-lighting lamps into infrared electroheating. Such usually less-efficient approaches shift cost from replacement parts to electricity. By hindering such inefficient uses this proposal will enable and enhance energy efficiency in infrared electroheating as well.

It would probably have been possible to get to this result by a different definition of 'light-source', but the interference between light source and infrared source caused by the very generic approach seems indeed best resolved through this exception. But to keep processes and industry inside the EU territory this exception is mandated.

[6] As defined in the harmonised standard EN 60519-1: 2020, *Safety in installations for electroheating and electromagnetic processing – Part 1: General requirements*

ANNEX III 3. New exemption x) – small infrared bulbs for piglet, poultry and food heating

Proposed is to introduce an extra exemption

> "*Incandescent DLS fulfilling all of the following conditions: E27 cap, clear envelope, power ≥ 100 W and ≤ 400 W, CCT ≤ 2500 W, specifically designed and marketed for infrared heating.*"

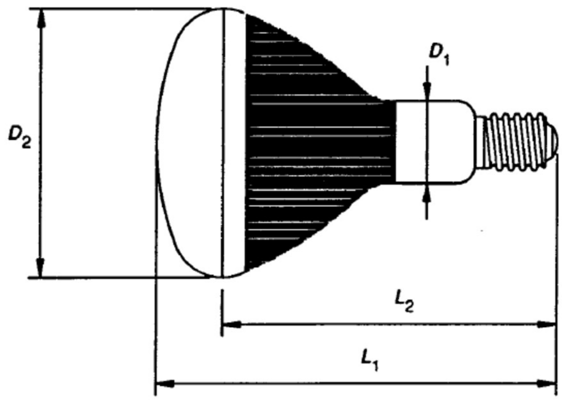
This is a specific application, outside the direct responsibility of IEC TC 27[7]. From an industrial electroheating perspective, this design is not needed (as is explained in argument f) above.

The typical design is following EN 60240 as given in Figure 1: They are either incandescent bulbs or today can be fitted with a small halogen burner inside the bulb. Quite often, the clear part of the bulb is coated with a red coating to reduce glare.

Such lamps without an anti-glare coating are examples of typical 'heat balls'.

To have any clear distinction between general lighting and this *specifically designed and marketed for infrared heating*, an obvious distinction would be preferred, like a red coating. Such a coating does not interfere with the *infrared heating*, but reduces usability for general lighting.

5.1 Infrarotreflektorlampen



Bemessungsleistung	W	150, 250 und 375						
Bemessungsspannungsbereich	V	100–110	110–120	115–125	125–130	220–230	220–240	230–250
Konstruktions-Spannung	V	105	115	120	127	225	230	240
Sockel (siehe IEC 61)							E27 E26 1)	
Größter Durchmesser des Kolbenhalses D_1	mm						42	
Größter Durchmesser des Kolbens D_2	mm						130	
Größte Länge über alles L_1	mm						195	
Abstand vom Bodenkontakt des Sockels zum größten Durchmesser des Kolbens L_2	mm						148 ± 10	
Maximal zulässige Sockeltemperatur	Nieder-Temperatur-Betrieb						250 °C	
	Hoch-Temperatur-Betrieb						275 °C 2)	
Maximal zulässige Kolbentemperatur	Nieder-Temperatur-Betrieb						250 °C	
	Hoch-Temperatur-Betrieb						420 °C 2)	
Ausstrahlungswinkel							Vom Hersteller anzugeben	

1) Für die Anwendung in Nordamerika und Japan
2) In bestimmten Ländern ist es üblich, auch einen Strahler mit extremem Hoch-Temperatur-Betrieb zu liefern, für den eine maximale Sockeltemperatur von 325 °C und eine maximale Kolbentemperatur von 500 °C zugelassen ist.

Figure 1 – Definition of infrared-reflector lamps from DIN EN 60240: 1992[8]

[7] IEC TC 27 Business-plan, www.iec.ch/tc27

[8] This IEC standard is withdrawn, it had been published by IEC TC 34, *Lighting*.

Proposed Amendments to (EU) 2019/2015 on labelling requirements

This regulation affects infrared electroheating emitters of the incandescent type above a specific colour temperature.

The radiation emitted by Incandescent emitters is placed on or near the planck-lokus[9]. For Carbon as filament material this is obvious as Carbon acts quite like a black emitter. But even metals, like Tungsten, Osmium, Rhodium or similar deviate only slightly.

Two major issues arise:

1 – Measuring or calculating product parameters

The commission proposes a new recital

> *"The relevant product parameters should be measured or calculated using reliable, accurate and reproducible methods. Those methods should take into account recognised state-of-the-art measurement methods including, where available, harmonised standards adopted by the European standardisation bodies (…)"*

For infrared electroheating emitters such measurement and calculation methods have been defined in the European standard EN 62798 ed. 1, *Industrial electroheating equipment – Test methods for infrared emitters*. This international standard has been developed at the IEC and applies to all kinds of devices emitting infrared radiation including but not limited to incandescent infrared emitters and intended to be used in industrial applications. The test methods are applicable to commercial equipment as well.

For incandescent light sources some of the parameters defined in (EU) 2019/2015 ANNEX V are mandated by other legislation[10]. Some parameters are defined by the colour temperature and mathematical models are available in the peer reviewed literature (including patents, standards or textbooks) that allow for a direct calculation[11]. Such mathematical relationships connect total mains efficacy η_{TM} (lm/W) with colour temperature as well, thus enabling a direct calculation of the energy efficiency class as defined in ANNEX II.

Some manufacturers design and manufacture infrared emitters for industrial electroheating in small numbers or on a made to order base, others provide individually crafted emitters. In all cases the colour temperature is known (often it is calculated using software) with deviations between real product and calculation much smaller than 100 K[12]. Measuring relevant data of each emitter would cause prohibitive extra cost without any gain and thus in effect prohibit the manufacturing of such emitters. Calculating dependent properties for any type using well established relationships minimises this burden.

Therefore, the introduction of this new recital is strongly supported with a minor addition:

> *The relevant product parameters should be measured or calculated using reliable, accurate and reproducible methods. Those methods should take into account recognised state-of-the-art measurement or calculation methods including, where available, harmonised standards adopted by the European standardisation bodies (…)*

This may lead to minor adaptions throughout the regulation as well.

[9] Rutgers GAW & De Vos JC (1954) Relation between Brightness, Temperature, True Temperature and Colour Temperature of Tungsten. Luminance of Tungsten. Physica XX: 715-720.

[10] Low Voltage Directive and harmonised EN 60519-1: 2020, *Safety in installations for electroheating and electromagnetic processing – Part 1: General requirements*

[11] Rutgers GAW & De Vos JC (1954) Relation between Brightness, Temperature, True Temperature and Colour Temperature of Tungsten. Luminance of Tungsten. Physica XX: 715-720.

[12] EN 62798 ed. 1, *Industrial electroheating equipment - Test methods for infrared emitters*

2 – Consider an exemption for industrial infrared electroheating in ANNEX IV

*Incandescent light sources (…) specifically designed and marketed for industrial or professional electro-heating equipmen*t take a specific role. Most of them will be – with respect to lighting – in Energy Efficiency Class G (according to ANNEX II). This is the purpose of their design:

- With respect to product safety it is indicated to have low light emission to avoid hazards to the eye[13].
- The same holds with respect to energy efficiency for their intended purpose – they are intended to emit infrared radiation, not visible light.

Starting from this, it becomes highly questionable, if rated or useful luminous flux and luminous peak intensity or total mains efficacy η_{TM} (lm/W) are meaningful characteristics for such products at all. They are not included in the design process, but rather describe a non-intended and not controlled outcome of the design. Therefore neither the classification (ANNEX II) nor the labelling (ANNEX III) creates a relevant information for choosing high efficiency infrared emitters for industrial electroheating processes.

As argued before, infrared electroheating is highly energy-efficient, usually surpassing any other technical means with respect to its intended purpose – which is the transfer of heat into a substrate. But the label to be attached transports a contradicting message[14].

To resolve this issue, it is proposed to include into ANNEX IV Exemptions under 3. the exemption as in (EU) 2019/2020, slightly amended i.e.

> *Incandescent light sources with blade contact-, metal lug-, cable-, litz wire-, pin base-, metric thread- or non-standard customised electrical interface, encasing made from quartz-glass tubes, specifically designed, marketed and used for industrial or professional electro-heating equipment (e.g. stretch blow-moulding process in PET-Industry, 3D-printing, photovoltaic and electronic manufacturing.*

As is argued, the EE-label does not convey a meaningful message for this kind of emitter at all, it may rather lead to choosing less energy-efficient solutions without a label attached.

If the incandescent emitter is not used as indicated in this exemption, it falls back into the full responsibility to be labelled accordingly.

[13] EN 60519-1: 2020, *Safety in installations for electroheating and electromagnetic processing – Part 1: General requirements*

[14] Why should a user choose a class G infrared emitter, when other technical means have no label at all?

Thermoprocessing, infrared electroheating[15]

Thermoprocessing is one of the largest energy using sectors in the EU. A preparatory study under the ErP framework has been undertaken for furnaces (lot 4), not resulting in a dedicated regulation[16]. Nonetheless, there exist BREF documents including energy efficiency and including aspects of thermoprocessing, where best practices are laid out for the industry to consider[17].

Having in mind a decarbonisation and thus electrification of all sectors of industry and using aforementioned documents, electroheating becomes the way for industry, to move forward for thermoprocessing[18]. One technology mentioned in the documents and being part of electroheating is infrared electroheating.

In infrared electroheating, made to purpose high power radiation sources are used, to generate infrared or visible optical radiation for efficient and fast heat transfer to the product processed. Very high energy efficiency is usually only possible with dedicated incandescent emitters – only here is a full conversion of electric energy into radiation possible. Other means of conversion of electric energy into useful radiation, like fluorescent or even worse LEDs are much less efficient. The spectrum is chosen for maximum radiation transfer efficiency to the product in the process.

Such dedicated emitters generate an output radiation which is usually at or near the Planck Locus in the CIE diagram. Any infrared emitter will thus become a light source in the sense of the proposed draft, once the surface temperature of the incandescent material is at or above 1700 °C. This feature is independent of the gas filling (halogen or no halogen) and nearly independent of the material of the radiation source (usually Tungsten, but Osmium, Rhodium, Carbon and others are or have been used as well). These industrial purpose emitters are of course using the same technology, as incandescent lamps, but differ in many aspects. Such dedicated emitters are often made-to-purpose devices with high power rating exceeding 3 000 W: a voltage of 400 V is common, but 230 V or any simple division of 400 V or 230 V are used as well; amperage of 10 A to above 25 A are common. Voltage and amperage depends critically on details of the intended wavelength spectrum and geometry. Using such emitters as *light source* is prohibitively inefficient and costly.

Application of such emitters (now defined as *light sources*) is wide spread through all kinds of industries and includes processes, like

> bending, degassing, drying, filling, forming, gluing, hardening, heating, joining, laminating, rapid thermal annealing, soldering, tape laying, welding,

and sectors, like:

> aircraft, automotive, beverage, building, electronics, food, fibre reinforced materials, furniture, pharmacy, photovoltaics, plastics, printing, semiconductor, steel, wind energy.

As an illustrating collateral, the actual (EU) 2019/2015 will prohibit the use of infrared electroheating in many applications, including the manufacturing of the Airbus A400M and other aircraft, where some large scale structural parts are manufactured by using non-halogen light bulbs.

The actual (EU 2019/2015 includes in ANNEX III 3. (s) and (t) exemptions for some types of halogen incandescent emitters. This is clearly not sufficient, as halogen emitters are not well suited for many industrial processes. A collateral would be the offshoring of many industrial processes from the EU. Especially endangered are many small scale processes, well hidden in SMEs.

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[15] Revised from my "Assessment of the future Commission Regulation laying down eco-design requirements for light sources and separate control gears (…)" provided in November 2018

[16] https://circabc.europa.eu/sd/a/468c3956-4e3a-4903-a82d-596bbfa4c08d/ENTR%20Lot%204%20Final%20Report.pdf assessed 28.10.2018.

[17] http://eippcb.jrc.ec.europa.eu/reference/ assessed 28.10.2018.

[18] this is e.g. discussed by VDMA and pushed forward with their members.

The actual exemptions in ANNEX III 3. (s) and (t) are not performance based; they are not neutral with respect to technology. On the contrary they exempt one specific type (halogen) and prohibit all other (non-halogen incandescent, or any other including any future development[19]) without providing a rationale that would follow out of the aim of the draft regulation. To our understanding, EU legislation should be drafted performance based, i.e. not forbidding specific technics and enshrining others without a substantial need to do so.

[19] Development is under way for many years and at many different enterprises large and small, to alter or improve the emission of incandescent radiation sources used in infrared electroheating. Such alterations can lead to other spectral emission than observed today and is the purpose of some developments.