

Additional Input to the Commission Impact Assessment for a Review of the Scope Provisions of the RoHS Directive Pursuant to Article 24(1)

Report for the European Commission DG Environment under Framework Contract N° ENV.C.2/FRA/2011/0020

Final Report

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Disclaimer

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Contents

List of Tables	iii
List of Figures	iii
Abbreviations.....	iv
1.0 Background and objective	1
1.1 Policy context.....	1
1.2 Objectives	4
2.0 Input for European Commission impact assessment on electric bicycles falling under the scope of RoHS 2.....	6
2.1 Executive summary impact assessment electric bicycles	6
2.2 Procedural issues.....	7
2.3 Problem definition and background	8
2.3.1 <i>Legal background</i>	9
2.4 Objectives	10
2.5 Policy options	11
2.6 The baseline	11
2.6.1 <i>RoHS compliance</i>	2
2.7 Results from the public consultation.....	5
2.8 Analysis of impacts	5
2.8.1 <i>Impact indicators</i>	6
2.8.2 <i>Environmental impacts</i>	7
2.8.3 <i>Economic impacts</i>	9
2.8.4 <i>Social impacts</i>	14
2.9 Comparison of options.....	16
2.10 Recommendation	17
2.11 References	18
3.0 Input for European Commission impact assessment on possible changes to Articles 2(2), 4(3) and 4(4)	19
3.1 Executive summary	19
3.2 Procedural issues.....	20
3.3 Problem definition and background	21
3.3.1 <i>Definitions</i>	23
3.4 Objectives	25
3.5 Policy options	25
3.5.1 <i>The baseline</i>	26
3.5.2 <i>Analysis of impacts for policy options</i>	35

3.5.3	<i>Analysis of Impacts for product examples</i>	41
3.6	Conclusions	57
3.7	Monitoring and Evaluation	58
3.8	Recommendations	58
3.9	References	59
A.1.0	Appendix 1: Definition of electric bicycles relevant for this assessment	61
A.2.0	Appendix 2: Data on bicycle sales and production in the EU	63
A.3.0	Appendix 3: End of Life Vehicles Directive – exemption status screening.....	66
A.4.0	Appendix 4: Full evaluation of policy options.....	73
A.5.0	Appendix 5: Statistic data for the manufacture of lighting articles in the EU 27	83
A.6.0	Appendix 6: Statistic data for the manufacture of generating sets in the EU 27	85
A.7.0	Appendix 7: Statistic data for the manufacture of toys in the EU 27	87
A.8.0	Appendix 8: Summary of stakeholder contributions.....	89

List of Tables

Table 2-1: Compilation of data concerning bicycle trade and EPAC trade in the EU 27 and individual countries	14
Table 2-2: Selected data for the German bicycle sector	1
Table 2-3: Impact indicators for the product group EPACs	6
Table 2-4: Legend for impact characterization	6
Table 2-5: Comparison of options	16
Table 3-1: Matrix for defining product groups with varying properties relevant for the evaluation.....	23
Table 3-2: Legend for impact characterization	37
Table 3-3: Evaluation of policy options	38
Table 3-4: Impact expected in Option 1 for products with integrated lighting.....	45
Table 3-5: Compliance of petrol powered garden equipment with the RoHS substance restrictions	52

List of Figures

Figure 2-1: EU27 bicycle manufacture between 2001 and 2012: sales (thousands of units) and evolution (%)	13
Figure 2-2: EPAC sales in the EU27 between 2006 and 2012: units sold (in thousands) and sales evolution (%).....	13

Abbreviations

Cr VI	Hexavalent Chromium
E-bike	Electric bicycle
EPAC	Electric power assisted cycle, used in this report when bicycles with the specifications listed under Article 1(1)(h) of Directive 2002/24/EC are referred to
IA	Impact Assessment
Pb	Lead
RoHS	Restriction of Hazardous Substances Directive
SME	Small and Medium Enterprises

1.0 Background and objective

1.1 Policy context

In 2008 the European Commission launched the recast of the RoHS 1 Directive 2002/95/EC in order to strengthen and adapt the existing law. A proposal for the RoHS recast (COM (2008) 809 final) was published in December 2008, accompanied by an impact assessment. This Commission proposal aimed at the alignment with REACH (as regards the assessment of substances under RoHS) and with the New Legislative Framework (CE Marking and EU Declaration of Conformity); it also introduced new definitions and extended the original RoHS 1 scope to medical devices (category 8) and monitoring and control instruments (category 9).

Substantial changes were made to this proposal by the Council and the Parliament before adoption on 8th June 2011 as Directive 2011/65/EU, also known as RoHS 2. The Directive legal text is available under:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32011L0065:EN:NOT>

The most significant changes included the introduction of an open scope through addition of product category 11 "other electrical or electronic equipment - EEE" (making the Directive applicable to all EEE) and an introduction of a broader interpretation of EEE, as a result of a new definition of the dependency on electricity. These changes to the Commission recast proposal were not impact assessed; nevertheless the RoHS 2 Directive 2011/65/EU (RoHS 2 Directive, hereafter referred to as RoHS 2), published in the OJ in July 2011, incorporates all these elements (see RoHS 2 Articles 2(1), 3(2) and Annex I category 11). These changes provide the initial outline for products considered to be "newly in scope", aside from the products and devices falling under categories 8 and 9. The RoHS 2 Directive, through its Article 2(4), provides a ten entry list of specific equipment which is excluded from the scope, e.g. aerospace and military equipment, means of transport (with the exception of electric two wheel vehicles which are not type approved), large-scale fixed installations, and photovoltaic panels. These are, at the moment, the only EEE that do not fall under the scope of the new Directive.

Also introduced by the Council and the Parliament, RoHS 2 foresees a transitional arrangement until 22nd July 2019 for electrical and electronic equipment that was formerly outside the scope of RoHS 1 but that is now in scope (see Article 2(2)¹). The transition period does not change the legal status of these products as non-compliant. It only means that products newly in scope may still be placed and circulated on the EU market until 22nd July 2019, even if they do not comply. At the end of this period, however, EEE that is non-compliant may not be further circulated on the market – i.e., it cannot be resold or refurbished and no secondary market operations

¹ Directive 2011/65/EU, Article 2(2): „Without prejudice to Article 4(3) and 4(4), Member States shall provide that EEE that was outside the scope of Directive 2002/95/EC, but which would not comply with this Directive, may nevertheless continue to be made available on the market until 22 July 2019.”

are possible. This change in status at the end of the transition period was also not subject to impact assessment.

Immediately after the adoption of RoHS 2, the Commission launched a study² for a screening of the un-assessed scope related changes from the 2008 Commission proposal to the final RoHS 2 text. The study identified three different types of scope related problems:

- The need for one or two additional exclusions of product groups from the scope, namely electric bicycles and pipe organs.
- RoHS restrictions apply to products when they are placed on the market. Once on the market, they may be circulated without further restrictions. However, only compliant products (at the time they are placed on the market) can benefit from this protection from retroactive measures. In this context, the Article 2(2) transition period has significant unintended retroactive side-effects. As a consequence of the current wording, non-compliant products that have been placed on the market (made available for the first time) between January 2013 and July 2019, are not allowed any secondary market operations after 22nd July 2019. This affects all products newly in scope, including non-compliant medical devices and monitoring and control instruments (EEE categories 8 and 9) placed on the market before their specific Article 4(3)³ compliance dates (22nd July 2014/2016/2017).
- Article 4(4) lists spare part provisions for the old product categories and for medical devices and monitoring and control instruments. The spare part provisions correspond to the product group compliance dates in Article 4(3), so that old products containing RoHS restricted substances can still be repaired later on with the original spare parts. This is based on the principle that in most cases the extension of the EEE life-time is both economically and ecologically desirable. However, Article 4(4) does not provide a spare parts provision for products newly in scope, other than medical devices and monitoring and control instruments, meaning that products falling within this category, placed on the market lawfully until July 2019, cannot be repaired if cables and spare parts are not RoHS compliant. In this regard it must be noted that Article 4(4)(f) provides a spare part provision for EEE which benefited from an exemption and which was placed on the market before the exemption expired. Some may argue that the transition period provided in Article 2(2) is to be understood as an exemption, meaning that articles placed on the market before 22nd July 2019 could still be repaired with non-compliant parts.

² See BIO Intelligence Service (2011), Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive, Final Report prepared in collaboration with ERA Technology for the European Commission, DG ENV, available under the following [link](#).

³ Directive 2011/65/EU, Article 4(3): „Paragraph 1 shall apply to medical devices and monitoring and control instruments which are placed on the market from 22 July 2014, to in vitro diagnostic medical devices which are placed on the market from 22 July 2016 and to industrial monitoring and control instruments which are placed on the market from 22 July 2017.”

However, Article 4⁴ clarifies all categories or applications which benefit from an exemption from the substance restriction of Article 4(1)⁵ and it does not refer to Article 2(1). The only exemptions that are not specified within the Article 4 items are the exemptions listed in annexes III and IV referred to in Article 4(6). It is thus interpreted that articles newly in scope cannot be repaired once placed on the market unless they are compliant or have a spare parts provision such as those existing for Cat. 8 and 9.

Pursuant to Article 24(1) of the Directive, no later than 22nd July 2014, the Commission is to examine the need to amend the scope of the Directive and shall present a report thereon to the European Parliament and the Council, accompanied by a legislative proposal, if appropriate, with respect to any additional exclusions related to that EEE.

The European Commission is planning to introduce the necessary adjustments to the scope provisions in the RoHS Directive, i.e. exclusions from the scope and adjustments to Article 2(2), 4(3) and 4(4), if proven necessary by the results of the Commission Impact Assessment, in the course of the mandatory Article 24(1) review.

The following input to the Commission Impact Assessment is already available:

- A study by COWI for the Danish Ministry of the Environment of 2010, addressing selected aspects and product categories under a potential open RoHS 2 scope (<http://www2.mst.dk/udgiv/publications/2010/978-87-92617-50-7/pdf/978-87-92617-51-4.pdf>);
- A study by BIOIS and ERA for the European Commission, identifying possible problem areas due to the scope related changes in the RoHS 2 text after the Commission recast proposal; final report online since July 2012 (<http://rohs.biois.com/product-group-factsheets>); and
- A UK study from November 2012 exploring some of these issues from an economic perspective (http://www.legislation.gov.uk/ukxi/2012/3032/pdfs/uksifia_20123032_en.pdf).

⁴ The dates for coming into scope of new categories are specified in Article 4(3); Article 4(4) allows the use of non-compliant cables and spare parts in specified applications and categories; Article 4(5) provides a limited exclusion for use of refurbished spare parts and it is only Article 4(6) which is understood to refer to the exempted applications, reading: “*Paragraph 1 shall not apply to the applications listed in Annexes III and IV.*”

⁵ Directive 2011/65/EU, Article 4(1): „Member States shall ensure that EEE placed on the market, including cables and spare parts for its repair, its reuse, updating of its functionalities or upgrading of its capacity, does not contain the substances listed in Annex II.”

Oeko-Institut, supported by Eunomia, has been appointed by The European Commission⁶, to give additional input to the Commission Impact Assessment for a review of the scope of provisions of the RoHS 2 Directive pursuant Article 24(1). This input is to regard two main areas:

- A possible exclusion for electric bicycles from the scope of RoHS; and
- Technical and socio-economic considerations relevant for assessing the impacts of various possible amendments to Articles 2(2), 4(3) and 4(4).

1.2 Objectives

Against the background detailed above, the following objectives were specified for this project:

- An assessment of the impacts of a possible exclusion for electric bicycles is to be carried out. In this regard, the initial assessment prepared by BIOIS is to be deepened and substantiated with regard to:
 - The clarification of technical characterisations of various product types in respect with the use of RoHS substances; and
 - The review and quantification of impacts of a baseline scenario regarding no further additions to the Article 2(4) exclusions and of a scenario in which an exclusion is to be added regarding electric bicycles.
- An assessment of the impacts of various possible amendments to Articles 2(2), 4(3) and 4(4) is to be carried out. This assessment shall include:
 - The identification and development of the possible scenarios for implementation. This is to include identification of impacts as well as their geographical and time relevance;
 - The development of product categories to be reviewed in the assessment of proposed policy options. Where possible ,example products shall be specified for theses product categories;
 - A desk-based survey of available information and literature aimed at establishing the costs and benefits tied to the various scenarios; and
 - Compilation of the obtained information to assess the impacts of the identified scenarios on a qualitative and, where possible, quantitative basis.
- Preparation and running of an online stakeholder consultation with a duration of 8 weeks, aimed at collecting information on products affected by possible changes to Articles 2(2), 2(4), 4(3) and 4(4) (following the Commissions' minimum standards);

⁶ Contract is implemented through Framework Contract No. ENV.C.2/FRA/2011/0020 led by Eunomia

The compiled information prepared as input for the European Commission's Impact Assessment concerning possible changes to the scope of the RoHS Directive is separated into two parts:

- Input concerning a possible exclusion of electric bicycles for the EU COMs IA (possible exemption);
- Input concerning possible changes to Articles 2(2), 4(3), and 4(4) of the RoHS Directive.

2.0 Input for European Commission impact assessment on electric bicycles falling under the scope of RoHS 2

2.1 Executive summary impact assessment electric bicycles

With the coming into force of RoHS 2, an open scope has been adopted concerning products that need to comply with the substance restrictions as well as with other administrative obligations. To accommodate this change, the new Category 11 was added to Annex I of the Directive, which lists the relevant product groups that are in scope. Category 11 is specified as “Other EEE not covered by any of the categories listed above”. Among others this category includes electric bicycles, which do not fall under the other categories, but which have electrical components and are thus obliged according to RoHS 2 to comply with the various requirements.

Article 2(4)(f) provides an exclusion for some two wheel electric vehicles. However, vehicles which do not need to be type approved do not currently benefit from this exclusion. To this end, where electric bicycles are concerned, those currently in the scope of RoHS are understood to be “...cycles with pedal assistance which are equipped with an auxiliary electric motor having a maximum continuous rated power of 0.25 kW, of which the output is progressively reduced and finally cut off as the vehicle reaches a speed of 25 km/h, or sooner, if the cyclist stops pedaling”.⁷

As there had been uncertainty whether the environmental benefits of RoHS compliance for electric bicycles justify the costs of compliance, information has been compiled and evaluated to provide input for the European Commissions’ impact assessment of this matter.

Available information suggests that most electric bicycles (if not all) placed on the EU market are already RoHS compliant. Further information was not provided by the bicycle industry, concerning future impacts that may be associated with further compliance efforts. In the absence of such information, it is assumed that either future costs are not significant enough to motivate industry to clarify the magnitude of impacts, or that they have incurred in the past and thus shall not have substantial impacts on the industry in the future.

The assessment of possible impacts of the inclusion of electric bicycles in the scope of RoHS was based on the understanding that the EU industry has achieved compliance, as attested. Non-EU industry in contrast was assumed to still have some efforts

⁷ There could be a number of other two wheeled electric vehicles which are also not required to be type approved. Electric scooters and Segway devices may be possible examples, also having two wheels and in some cases an electric motor. However, the consultants have not regarded such vehicles in the review, as the technical specifications of this project referred specifically to electric bicycles as the subject of a possible exclusion and not to all electric two-wheel vehicles which are not type approved. In this sense, other devices are understood not to fall under the product group electric bicycles.

to this end, as hexavalent chromium may still be contained in chrome-plated screws. On this basis, it was demonstrated that some environmental benefits may incur if electric bicycles are kept in scope. In parallel, repair enterprises may have some costs associated with the training of personnel and with retaining repair services for all models in the transition period between non-compliant and compliant models. Such costs are however assumed to be short termed and to have possibly already incurred, meaning that remaining costs would either be negligible or non-existent. Further possible impacts on competition are understood to be distributional shifts of up to 4% of market share between non-EU and EU manufacturers. As such costs are understood to be short termed and to incur before full compliance is required in 2019, they are also assumed to be negligible or non-existent. The fact that industry has claimed compliance as early as 2012, further supports that such costs will not be significant.

Possible impacts, beyond the electric bicycle industry, are not expected to occur as a result of compliance with the RoHS substance restrictions: The electric bicycle industry is not expected to have significant impacts on the conventional bicycle industry. Furthermore consumers' likeliness to acquire non-type approved electric bicycles is not expected to shift in light of the decision to include or exclude such bicycles in scope. Thus, there appears to be no reason to change the status of non-type approved electric bicycles in terms of being included in the scope of RoHS.

2.2 Procedural issues

In 2011–2012, BIOIS carried out a study for the European Commission in which, inter alia, impacts for various product groups newly to be included in the scope of RoHS were investigated to clarify the potential for costs and benefits of this inclusion. Non-type approved electric bicycles were one of the product groups investigated in this context. The BIOIS study report⁸ concluded that no environmental benefits were to be expected from the inclusion of non-type approved electric bicycles in the scope of RoHS, whereas social benefits were expected to a very limited extent – if at all. The report thus recommended adding an exclusion for non-type approved electric bicycles to Article 2(4) of the directive. When the results of the report were later reviewed by Member States, some of the representatives felt that a further substantiation was necessary to conclude without doubt if an exclusion should be provided or not. A further study (resulting in this report) was thus commissioned by the EU COM in 2013, which includes further substantiation of the information available for this product group to facilitate a final decision in this regard.

In the course of the current project, a stakeholder consultation⁹ was held between 13th December 2013 and 10th March 2014. Stakeholders were provided with a short

⁸ BIO Intelligence Service (2012), Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive, Final Report prepared in collaboration with ERA Technology for the European Commission, DG ENV, Retrieved 20.01.2014 from: [http://rohs.biois.com/documents/RoHS_II_IA_Final Report.pdf](http://rohs.biois.com/documents/RoHS_II_IA_Final%20Report.pdf)

⁹ For further information see Consultation page under <http://rohs.exemptions.oeko.info/index.php?id=208> and electric bicycles section under <http://rohs.exemptions.oeko.info/index.php?id=209>

summary of the aim of the project and the scenarios that would be investigated, as well as with a questionnaire outlining the main areas where information was needed. Various manufacturers of bicycles and bicycle components were invited to participate in this exercise, to ensure that the industry was informed of the opportunity to provide input. Despite this effort only a single contribution was submitted during the consultation, on behalf of the Swedish Chemicals Agency (KEMI)¹⁰, of the opinion that non-type approved electric bicycles should be kept in the scope of RoHS. In light of the limited input to the consultation, a further effort was made to contact a number of bicycle manufacturer associations in order to confirm the various assumptions relevant for this investigation. Some information, which is reflected in the next sections, was collected through interviews held with such representatives as well as from documents to which they made reference. Association representatives also assisted in a further attempt to contact and receive information from the bicycle industry; however no substantial information was provided beyond general statements.

2.3 Problem definition and background

According to the current RoHS regulation, electric bicycles need to be RoHS compliant so that they can be placed on the EU market¹¹. As non-type approved electric bicycles are considered to be a product newly in scope, the requirement of their compliance with the substance restrictions came in to force at the beginning of 2013. Nonetheless, as a result of Article 2(2), non-compliant EEE considered to fall under product groups newly in scope, may still be made available on the EU market until 22nd July 2019. The substance restrictions are to apply to all components – electrical ones as well as non-electrical ones.

There are concerns that the impacts of enforcing this legal requirement may result in costs which significantly outweigh the benefits of its implementation. Though the benefits of eliminating the use of RoHS substances in non-type approved electric bicycles remain to be quantified, it is possible that compliance with the RoHS substance restrictions may result in significant costs. In this regard, the consultants have identified two scenarios in which the indirect costs of compliance could be significant enough to justify an exclusion of this product category from RoHS:

- If the compliance of electric bicycles with the Directive results in significant costs for the conventional bicycle industry in light of the requirements for compliance covering all bicycle parts and not just electric parts (i.e., where parts for all bicycles types have mutual production lines and processes, costs may incur if RoHS substances are in use in the non-electric components);

¹⁰ KEMI (2014), contribution of Swedish Chemicals Agency (KEMI) to Stakeholder Consultation Concerning the Scope Review of the RoHS Directive, submitted on 10.03.2014, available under: http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_KemI_comments_to_SC_RoHS_2014_1_Scope_review.pdf

¹¹ A product is considered compliant if it either a) does not contain any RoHS restricted substances above the %/weight specified in Annex II of the Directive or b) if the remaining use of RoHS restricted substances in the relevant components is allowed through an existing exemption listed in Annex III of the Directive, at the time the end-product is placed on the EU market.

- If the compliance of electric bicycles with the Directive impacts on sales of electric bicycles and results in a continued use of private motorized transportation (i.e., cars, motorcycles). This counter-trend could result in significant costs for the environment and for society (i.e., increased emissions to air, increased traffic congestion, increased demand for parking spaces, etc.).

The definition of electric bicycles varies greatly, with most EU countries referring to some form of electric assistance with which the cycle is equipped. The German ADFC¹² makes a distinction between three main types:

- The Pedal Electric Cycle (pedelec) is a bicycle in which the user is assisted with an electric motor of up to 250 Watts, which is cut-off once the 25 km/h speed is reached. Such vehicles are not type approved, meaning that consumers do not need a license plate nor a permit or driver's license. In pedelecs, the motor assistance can only kick in when the user is pedalling. There are also pedelecs with motor assistance until a cut-off speed of 6 km/h.
- Fast pedelecs, referred to as S-Class pedelecs, have a cut-off speed of 45 km/h as well as a higher motor rating of 500 Watt, thus excluding them from the non-type approved category. As vehicles must be type approved, they require a license plate as well as users to hold a moped permit or driver's license¹³.

Electric bicycles are a third category and can be compared with a moped to some degree. The motor can be activated independently, regardless of whether the user is pedalling or not. These vehicles must also be type approved (with the consequences as described above).

To conclude, from these three types of electric bicycles, only pedelecs are understood not to require type approval. The other two types are thus understood to benefit from the Article 2(4)(f) exclusion and are not the subject of this review.

2.3.1 Legal background

Article 2(4) (f) of the RoHS Directive provides an exclusion from scope for “*means of transport for persons or goods, excluding electric two wheel vehicles which are not type approved*”. The double negation is interpreted to mean that two wheel vehicles which do not need to be type approved (including pedelecs) are in the scope of the RoHS Directive, thus needing to comply with the substance restrictions as well as other obligations.

¹² Adopted from ADFC website – electric cycle types, available under: <http://www.adfc.de/pedelecs/elektro-rad-typen/elektro-rad-typen>; last accessed 14.5.2014

¹³ Consultants note: The conditions that must be fulfilled for the type approval of a vehicle may vary between countries, concerning the requirement for users to hold a moped permit, a driver's licence, insurance, etc.

Article 1(1) in Chapter 1 of Directive 2002/24/EC¹⁴, relating to the type-approval of two or three-wheel motor vehicles, specifies vehicles to which the Directive does not apply and which are thus understood to be non-type approved (See detail in Appendix A.1.0). Article 1(1) (h) in the list of non-type approved vehicles is the only article referring to cycles as well as to an electric rated power:

(h) cycles with pedal assistance which are equipped with an auxiliary electric motor having a maximum continuous rated power of 0,25 kW, of which the output is progressively reduced and finally cut off as the vehicle reaches a speed of 25 km/h, or sooner, if the cyclist stops pedalling.

It is thus assumed that two wheel vehicles falling under this article would be considered non-type approved electric two wheel vehicles, which at present are required to be RoHS compliant. No further two wheel electric vehicles are specifically mentioned elsewhere in the 2002/24/EC Directive Article 1(1) list. As the technical specifications of this project refer to an assessment of a possible exclusion of electric bicycles, the following assessment has been performed for pedelecs, which are understood:

- To be an electric vehicle;
- To have two wheels;
- Not to require type approval; and
- To fall under the product group “bicycle”

Though it is possible that additional vehicles are non-type approved electric two wheel vehicles, it is assumed that none of these would be understood to be a bicycle, and thus none of these would benefit from any possible changes to the status of electric bicycles in the context of the RoHS Directive for which this assessment has been performed. Thus, the assessment shall refer to bicycles with the specifications listed under Article 1(1)(h) of Directive 2002/24/EC also referred to as pedelecs. The term electric power assisted cycles (EPAC) shall be used to refer to such vehicles from here on.

2.4 Objectives

The objective of both the RoHS recast proposal (COM (2008) 809 final) as well as RoHS 2 (2011/65/EU) is “to contribute to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste EEE”.¹⁵

The purpose of this project is to look at the impacts of EPACs falling in the scope of RoHS 2 compared to an alternative in which they are to be excluded from the scope of RoHS, thus not required to comply with the substance restrictions. Policy options

¹⁴ See <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02002L0024-20130701&from=EN>

¹⁵ 2011/65/EU, Article 1

are thus evaluated according to ability to reach the abovementioned overall objective of the RoHS Directive, as well as whether they lead to one of the following scenarios:

- Compliance of electric bicycles with the Directive results in significant costs for the conventional bicycle industry, in light of mutual production lines and the need to adapt production towards compliance with RoHS;
- Compliance of EPACs with the Directive creates an observable shift of individuals away from the use of electric bicycles¹⁶, resulting in the continued use of private motorized transportation with subsequent costs to the environment and for society.

2.5 Policy options

The policy options analysed are the following:

OPTION 1 (baseline scenario): Electric two wheel vehicles that are not type approved remain in the scope of the RoHS Directive. As explained in Section 2.3.1, this is understood to regard EPACs, such as pedelecs, which fall under the Article 1(1)(h) definition of Directive 2002/24/EC, Chapter 1.¹⁷

OPTION 2 (exclusion): Electric two wheel vehicles that are not type approved are excluded from the scope of the RoHS Directive.

Although the possibility of a third option was debated regarding an exclusion for a sub-group of electric two wheel vehicles (e.g. electric bicycle sub-groups, whose compliance would result in additional costs for the conventional bicycle industry in comparison with sub-groups where no such costs are foreseen), the information collected from the various sources did not clarify that such a distinction is relevant.

2.6 The baseline

Data collected concerning bicycles for the EU, under EUROSTAT, is not detailed enough to provide insight into the market share of EPACs from all bicycle sales.

Available data for the EU is based on information provided COLIBI, *the Association of the European Bicycle Industry* and COLIPED, *the Association of the European Two-Wheeler Parts' & Accessories' Industry*, which publishes annual data representing registered members. The 2013 report¹⁸ summarizes the various market trends relevant

¹⁶ The term, electric bicycles, includes other two wheel electric cycles besides EPACs, as described towards the end of Section 2.2. EPACs are the most commonly used of such devices in the EU, however in general, a shift from liquid fuel using vehicles towards E-bikes would be understood to have positive impacts on the environment and on society.

¹⁷ See <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02002L0024-20130701&from=EN>

¹⁸ Colibi & Coliped (2013), European Bicycle Market, 2013 Edition, Industry & Market Profile (2012 statistics), available under: <http://www.colibi.com/docs/issuu/European%20Bicycle%20Market%20&%20Industry%20Profile%20-%20Edition%202013.pdf>

for bicycles in the EU in 2012. Presented data represents ~85% of the EU bicycle market. According to the report, approximately 20,000,000 bicycles are sold annually across Europe. Germany has the most significant proportion of annual sales to consumers (3,966,000 in 2012) followed by the UK (3,600,000), France (2,835,000) and Italy (1,606,000).

It is understood that a large proportion of bicycles are manufactured within the EU. A more significant part of EU manufacture takes place in Germany (19%), Italy (19%), Poland (9%) and the Netherlands (8%).¹⁹

As for European manufacture of parts and accessories, the total value of production is estimated at 1,646 million €, with the main contributing countries being Italy (31%), Germany (29%), Romania (10%) and France (9%).²⁰

Concerning the sales of EPACs, 854,000 units were sold in the EU in 2012, with the largest portion of sales in Germany (44% - 380,000 units) and the Netherlands (21% - 175,000 units) and all other countries with a sales share below 5%. From an EU perspective, this accounts for less than 5% of the annual bicycle sales, whereas in Germany the EPAC sales account for almost 10% and in the Netherlands for almost 20%. The EU data and evolution of sales of bicycles appear in Figure 2-1, and for sales of EPACs in Figure 2-2.²¹

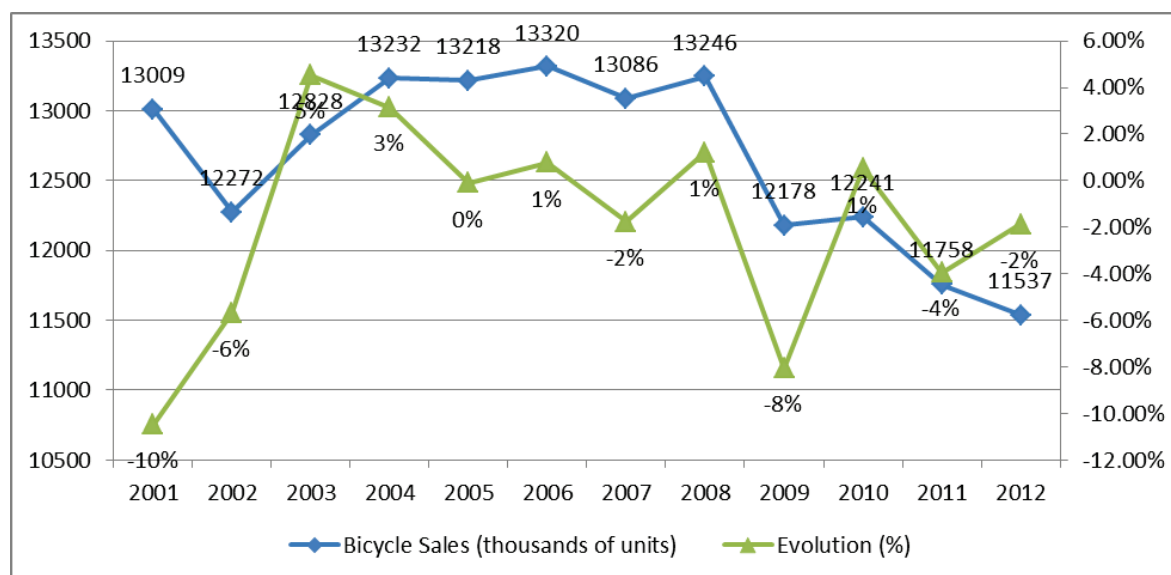
Table 2-1 presents data concerning bicycle trade and EPAC trade in the EU27 and in a number of countries understood to be more significant players for various aspects. Further Data from the Colibi & Coliped 2013 report is included in Appendix A.2.0.

¹⁹ Op. cit. Colibi & Coliped (2013)

²⁰ Op. cit. Colibi & Coliped (2013)

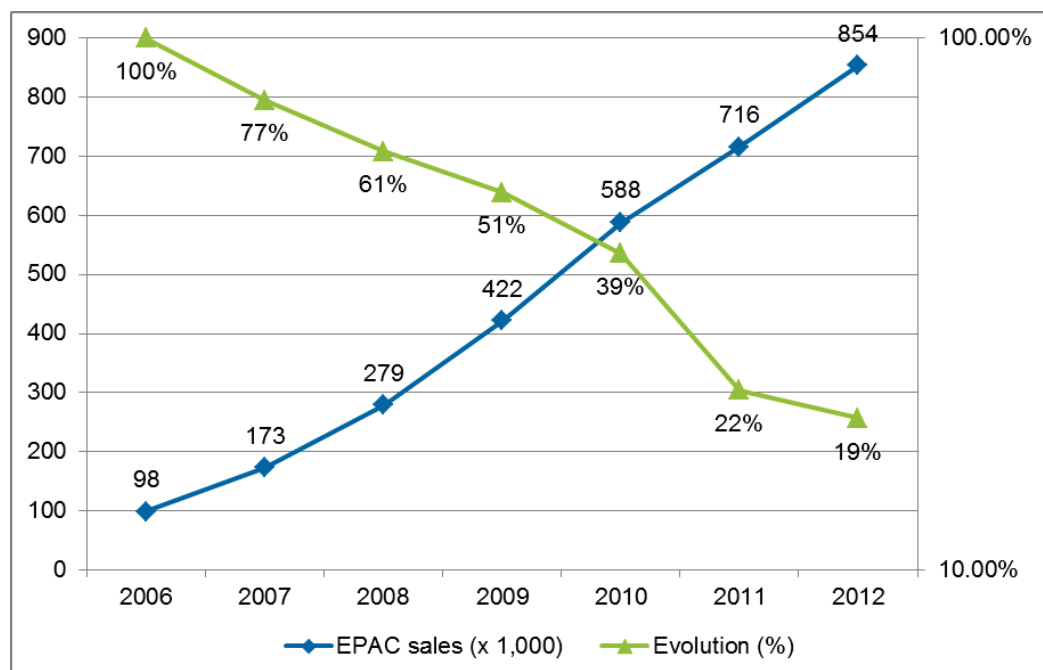
²¹ Op. cit. Colibi & Coliped (2013)

Figure 2-1: EU27 bicycle manufacture between 2001 and 2012: sales (thousands of units) and evolution (%)



Note: Evolution calculated based on the development of sales, compared to sales of the previous year.
Source: New illustration based on data from Colibi & Coliped (2013)

Figure 2-2: EPAC sales in the EU27 between 2006 and 2012: units sold (in thousands) and sales evolution (%)



Note: Evolution calculated based on the development of sales, compared to sales of the previous year. 2006 is referred to as the base year and thus specified as 100%. As stakeholders have explained that the market is starting to stabilise, and is expected to retain a market share of around 15%, it is assumed that this trend has become apparent in the market trend of 2013 and 2014, which are beyond the period reflected in this figure.

Source: New illustration based on data from COLIBI (2013)

Table 2-1: Compilation of data concerning bicycle trade and EPAC trade in the EU 27 and individual countries

	EU 27	France	Germany	Italy	Netherlands	Poland	UK
Bicycle sales in 2012	19,719,000	2,835,000	3,966,000	1,606,000	1,035,000	992,000	3,600,000
Bicycles sales in 2012 (%)	100%	14.4%	20.1%	8.1%	5.2%	5.0%	18.3%
Bicycle manufacture in 2012 (units)	11,537,000	850,000	2,211,000	2,195,000	900,000	1,076,000	40,000
Bicycle manufacture in 2012 (%)	100%	7.4%	19.6%	19.0%	7.8%	9.3%	0.3%
Average cost in €	not specified	278	513	269	724	210	305
Manufacture of parts in 2012	1,646,000,000	180,000,000	260,000,000	496,000,000	90,000,000	60,000,000	31,000,000
EPAC sales in 2012 (units)	854,000	46,000	380,000	46,000	175,000	5,000	30,000
EPAC sales in 2012 (%)	100%	5.4%	44.5%	5.4%	20.5%	0.6%	3.5%
Bicycle employment	13319	1000	2600	1600	1764	1200	50
Bicycle parts employment	7207	900	1300	1750	500	370	70

Source: Data compiled on based on Colibi & Coliped (2013)

In light of the availability of data and in light of Germany being a significant player both in terms of production and sales of bicycles and EPACs, further data was collected to enable an estimation of various impacts on the basis of the German market.

A document concerning the Economic Significance of the Bicycle Economy in Germany²² states that every year about 4 million bicycles and EPACs are sold in Germany (as evidenced in Table 2-1). The document then identifies the turnover of the German bicycle retail sector in 2012 at around 5 Billion € and had been growing steadily since 2008. The growth potential of the sector between 2010 and 2015 was estimated at 3.65% per annum. The total bicycle sector turnover however, is said to amount to over 16 billion €. At the time of the report it was estimated that there are over 69 million bicycles in Germany in stock, 700,000 of them being EPACs. In 2011 more than 300,000 pedelecs/e-bikes were placed on the German market. Data is compiled in Table 2-2 below.

Table 2-2: Selected data for the German bicycle sector

	All bikes (2012 data)	Pedelecs/e-bikes (2011 data)	Conventional (2012 data)	Comments
Bicycle sales	4,000,000	300,000	3,700,000	
Turnover from bicycle sales	5,000,000,000 €	-	-	Retail
Turnover of Bicycle sector	16,000,000,000 €	-	-	Industry, Retail, Tourism, Infrastructure, other
Yearly growth between 2010 and 2015	3.65%	-	-	
General amount of bicycles in Germany	69,000,000	700,000	68,300,000	
Price for average bicycle	-	1,975 €	600 €	
Price for premium bicycle	-	2,517 €	1,089 €	
Employed persons (full time)	278,000	-	-	Industry, Retail, Tourism, Infrastructure, other

Source: Data based on VSF (2012)

²² VSF (2012), Die wirtschaftliche Bedeutung der Fahrradwirtschaft in Deutschland, prepared by Albert Herresthal, VSF e.V. for the Vivavelo Press Conference held in Berlin on 23.02.2012.

The German Two-Wheel Industry Association (Zweirad-Industrie-Verband e.V. – ZIV) was contacted²³ to obtain further information for this assessment. The following points summarize the information made available through a number of interviews:

- In the German electric bicycle market, around 410,000 units are sold annually – around 400,000 being from the pedelecs type (and the remainder being E-bikes which must be type approved). The consultants note that this is a distribution of 97.5:1 between pedelecs and type approved E-bikes;
- The parallel numbers for the EU are around 1,200,000 units sold annually, with a distribution of 99:1 between pedelecs (or EPACs) and type approved E-bikes.

Despite earlier assumptions that envisioned the electric bicycle fraction of the market to become more dominant with time, it seems that the fraction of these from all bicycles sold is starting to stabilize and is expected to rise to around 15% and then have small fluctuations at that level (i.e., between 12–18% at the peak periods). A market share of 15-18% electric bicycles from the total bicycle market is expected in the coming years. That means a total number of more than 600,000 units per year. In the next years the increase of the electric bicycle sales is expected be 5 to 10% every year as an average across the EU.

2.6.1 RoHS compliance

As manufacturers of bicycles and EPACs did not contribute to the information collected about this sector in the course of this project, a double approach was used to establish this aspect. An earlier study prepared by BIOIS²⁴ regarding the inclusion of EPACs in scope was used as a first source of information concerning RoHS compliance. The following points have been raised concerning compliance in the report:

- *“Approximately 95% of pedelecs use a so-called hub motor located in the hub of either the front or the rear wheel. This is a space that is not normally used in conventional bicycles, which means that little engineering or design changes are needed and assembly and sourcing processes remain similar. Manufacturers of hub motors are largely based in Europe, Asia and North America.²⁵ Other electrical and electronic equipment in electric bicycles are the battery, display, sensors, controllers, and in some cases also the gear system. According to manufacturers, all these electronic components are already RoHS compliant.”*

Consultants note: It is further understood that manufacturers did not address differences in compliance of components manufactured in the EU and without,

²³ Interview held on 04.04.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

²⁴ BIOIS & ERA Technology (2012), Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive – Final Report. Retrieved from: http://rohs.biois.com/documents/RoHS_II_IA_Final_Report.pdf

²⁵ Cited in BIOIS (2012) as PRESTO Cycling Policy Guide, Give Cycling a Push, 2010, accessed at http://www.presto-cycling.eu/images/policyguides/presto_cycling%20policy%20guide%20electric%20bicycle.pdf

though it may be possible that this is a result of limited data from the supply chain.

- *“The average product life of an electric bicycle is estimated at 5 to 7 years²⁶, compared to approximately 15 years for a conventional bicycle.²⁷”*
- *“According to the stakeholder enquiry, the six RoHS substances are not on the bill of materials list for electric bicycles in Europe so the focus would have to be on the supply chain... [In EU manufacturing,] many European producers source their parts in Asia, notably China, and only assemble the final product in Europe.”*
- *“Very little if no information exists on RoHS substances in the non-electric components of electric bicycles... In case of electric bicycles, two potential applications of cadmium have been banned under REACH, which are its use in brazing alloys and plastics.”*
- *“Manufacturers contacted by ETRA (European Two-wheel Retailers’ Association) in this context stated that they are aware of RoHS and produce electric bicycles free of RoHS substances. This shows that even if none or not all manufacturers produce RoHS compliant electric bicycles, this kind of production is believed to be possible. Not one of the stakeholders mentioned that producing without RoHS substances would be impossible or even very costly.”*
- *“Hexavalent chromium might be thought to be found in coatings to avoid rusting but bicycles tend to be either chromium metal plated or painted and in both applications hexavalent chromium is not used. It is, however, possible to find it in screws” This was estimated in the BIOIS report to account for 100 µg per product.*
- *“... lead might be found in solder in the wiring of electrical components, but manufacturers repeatedly assured that all electrical components are already RoHS compliant.”*

As the current study was requested to substantiate technical and economic data for the case of an EPAC exclusion, further information was sought.

Following an interview²⁸, a ZIV representative contacted some manufacturers to collect additional data. Manufacturers, representing the EU bicycle manufacturing industry as well as the bicycle parts manufacturing industry, confirmed that their products did not have a problem with compliance with RoHS.²⁹ A possible explanation given by

²⁶ Cited in BIOIS (2012) as Stakeholder consultation contribution by ETRA, January 2012

²⁷ Cited in BIOIS (2012) as Dave, Shreya, *Life Cycles Assessment of Transportation Options for Commuters*, 2010, Massachusetts Institute of Technology (MIT)

²⁸ Interview held on 04.04.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

²⁹ Interview held on 20.05.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

ZIV was that the sector had assumed that EPACs would remain in scope³⁰. Uncertainty however, existed as to manufacturers outside of the EU.

It is further understood that 95% of manufacturers produce both electric and conventional bicycles, meaning that they would be expected to be aware if significant costs were to result from the need to comply with RoHS. ZIV have pointed out that electric bicycle parts and components are often built on the same production lines as conventional bicycles, however they are manufactured separately (different production batches) as the various parts must have different properties – the frame for instance must be more stable and is also built differently to accommodate integration of the motor.³¹ The consultants thus assume that applying RoHS requirements on EPACs is not expected to have significant impacts on the manufacture of conventional bicycles. As manufacturers have repeatedly stated that EPACs shall not have a problem with compliance, it is also understood that components that may still be supplied for both electric and conventional bicycles would also already not have a problem with compliance.

In this regard, the consultant would like to point out that the sector had a number of opportunities to contribute to the body of knowledge relevant for the review of this case (the BIOIS study as well as the current one). This was enabled through stakeholder consultations and meetings as well as through recurring attempts at direct contact. The fact that sector representatives have not seen a need to provide more detailed information attests that even if costs are expected from the inclusion in the scope of RoHS, these are not expected to be significant enough to seek to prevent changes in the regulation.

Additionally, the ELV³² Directive was screened as a basis for areas where substitution may not yet be possible, on the basis of the applicability of existing exemptions for the automobile industry. As both products are subjected to similar conditions (e.g. vibrations and impacts of mobility requiring stability of parts; need for operation under varying climatic conditions; relative long service times and reparability; etc.) it was assumed that even if the bicycle industry applied RoHS substances for some applications, if substitutes were available for the automotive industry, transition into scope should be technically possible. The ELV screening results are detailed in Appendix A.3.0. Earlier exemptions for cadmium and mercury have all expired and suggest that substitutes for the various components are available. For hexavalent chromium a single exemption is still on-going; this however is irrelevant for the bicycle industry as it is limited to cooling systems of motor-caravans. As the ELV Directive does not restrict poly brominated biphenyl and poly brominated diphenylether, the current status of

³⁰ The consultant's assume that following the BIOIS report, industry concluded that an exclusion was uncertain, as it was not communicated clearly by the EU COM if the results of the study were to be approved.

³¹ Interview held on 04.04.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

³² EU COM (2013), Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on End-of Life Vehicles (ELV), originally published in OJ L 269, 21.10.2000, p. 34), last consolidated version from 01.06.2013

the RoHS Directive in which no exemptions exist for these substances suggests that phase out has occurred and substitutes should be possible for electric components. As for lead a number of exemptions still exist for which bicycle applications may still be relevant:

- Ex. 1(a) for “Steel for machining purposes and batch hot dip galvanised steel components containing up to 0.35% lead by weight” may be relevant for the manufacture of bicycle frame and fork; seat post; and chain rings; In the consultants opinion these have higher processing requirements and thus are probably manufactured with other materials;
- Ex. 2(c) “Aluminium with a lead content up to 0.4% by weight” may be relevant for construction of frames; As EU manufacturers have claimed that EPACs can comply with RoHS, and as in most cases manufacturers produce both conventional and electric bicycles, it is assumed that this exemption would not be needed for the manufacture of EPAC frames.
- Ex. 8(e) through 8(h) as well as Ex. 10(b) are currently under review and could be relevant for some electric components. However, according to the various sources, it is understood that the electric components of EPACs shall not have a problem with compliance with RoHS.

2.7 Results from the public consultation

The results of the public consultation are limited to the response of the Swedish Chemicals Agency (KEMI)³³, of the opinion that E-bikes should be kept in the scope of RoHS, possibly falling under Category 7. This is explained in light of the BIOIS conclusion that electronic components are already RoHS compliant, and that their inclusion in the scope of the RoHS Directive is expected to have benefits for the internal market and a slightly positive health impact. In KEMI's opinion there is no reason to exclude EPACs from scope.

2.8 Analysis of impacts

As the baseline of this assessment is the current RoHS Directive in which non-type approved two wheeled bicycles (referred to as EPACs) are considered to be in scope, analysis of impacts shall only regard the differences between this Baseline Option (Option 1) and between the Exclusion Option (Option 2). Furthermore, since Article 1(1) in Chapter 1 of Directive 2002/24/EC³⁴ is understood to define the articles under review in this process, any estimation to be made shall refer to pedelecs.

³³ KEMI (2014), contribution of Swedish Chemicals Agency (KEMI) to Stakeholder Consultation Concerning the Scope Review of the RoHS Directive, submitted on 10.03.2014, available under: http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_Kemi_comments_to_SC_RoHS_2014_1_Scope_review.pdf

³⁴See <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02002L0024-20130701&from=EN>

2.8.1 Impact indicators

To clarify if an exclusion from the scope of RoHS would be justified, the analysis of the two options, must demonstrate that the benefits expected from the implementation of each scenario would be similar or larger than possible costs therefor. The overarching objective of the Directive is to contribute *“to the protection of human health and the environment...”*. This would require that costs and benefits relevant for the environment, for the economy and for society would be reviewed. On this basis, the following impact indicators have been chosen as relevant in this context:

Table 2-3: Impact indicators for the product group EPACs

Environmental indicators	Economic indicators	Social indicators
Impacts on air quality	Impacts to market structure	Impacts on employment
Impacts on energy consumption	Impacts to competition, including wider economic impacts (trade beyond the EU)	Impacts on consumers shift away from motorised vehicles to EPACs
Renewable and non-renewable resources	Impacts to manufacturing costs (EPACs /conventional bicycles)	Impacts on health
Waste – production, treatment and recycling	Impacts across the supply chain (suppliers and manufacturers of components, repair enterprises, secondary market operations)	
Noise emissions	Possible internal market distortions (enterprises dependent on EPACs production; retailers)	
	Possible impacts on consumers (product quality and availability)	

The following signs will be used in summarising the impacts:

Table 2-4: Legend for impact characterization

Sign	Significance
+++	Substantial positive effect
++	Positive effect
+	Slight positive effect
=	No effect
-	Slight negative effect
--	Negative effect
---	Substantial negative effect
?	Unknown effect

2.8.2 Environmental impacts

As explained above, it is understood that electric bicycles for the most part are already compliant with RoHS. In this regard it has been confirmed that both EPACs manufactured in the EU and EPAC parts manufactured in the EU are RoHS compliant. There exists uncertainty as to the full applicability of this statement for EPACs and parts imported to the EU. However, it is assumed that RoHS compliance is underway if not completed, in light of the current exemption status of both the RoHS and the ELV Directive suggesting that substitutes exist for most applications and are manufactured by many suppliers. In this sense it is anticipated that continuous manufacture of non-compliant parts would not be economical for the suppliers of many components used in other EEE and/or automobiles. It is thus assumed that in non-EU manufacture RoHS compliance has been established for the most part. As stakeholders have not provided information concerning the costs of compliance, nor its significance, it is assumed that switching back to non-compliant components would not be economic. It is thus not expected to occur for the most part, regardless of the decision to keep EPACs in scope or to exclude them.

The consultants thus conclude that environmental impacts expected to derive from the compliance of the sector with RoHS have already incurred for the most part if not completely. If EPACs are to be excluded from the Directive, a significant change is also not expected in light of the reluctance of the supply chain to manufacture non-compliant products for a sub-sector of relatively small market share. As the costs of compliance are assumed to have occurred, it could also be that industry would retain compliance in light of uncertainty of future changes to scope.

In this sense it is understood that environmental impacts are only relevant to a small degree in areas where compliance may not yet be complete, namely in imported products or components. This too is assumed to have a small range of applicability if at all. Cr VI was mentioned by BIOIS to possibly be present in products at a quantity of 100 µg per product. Other RoHS substances were estimated not to be present.

ZIV³⁵ have estimated that in the coming years, EPACs sales shall increase by 5-10% per annum. Based on the EPACs in the EU of 854,000 units in 2012, between 6.4 and 8.0 million EPACs are expected to come on to the market in the period between 2014 and 2019 (end of the transition period). During the first decade afterwards, between 15.9 and 29.2 million EPACs are expected to be placed on the EU market.

If it is assumed that only the imported (~41% at present) EPAC or part of it may still contain Cr VI, the worst case scenario would be that each of these contains 100 µg Cr VI, resulting in a total of 0.92 to 1.54 kg Cr VI coming on the market through this route between 2014 and 2029. As some of these probably also use Cr VI free screws, and as Cr VI metal plating is probably to be phased out slowly where possible in light of the hazardous properties of this substance, this is expected to be an over-estimation.

³⁵ Interview held on 04.04.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

It should be noted that Colibi & Coliped (2013) data only represents 2012 sales reported by members of the associations and the actual market may be somewhat larger. This is further supported by the assumption of ZIV that the EU market share of 2014 is 1,200,000, with 99% being pedelecs and the rest being electrical bicycles that would need to be type approved and thus excluded from RoHS. Based on this assumption, if EPACs still use screws with Cr VI in the above specified quantity throughout the assessed period, this would result in about 20% more Cr VI coming on the market. This total quantities would then be 0.34 to 0.38 Kg Cr VI coming on the market between 2014 and 2019 and a total of 1.17 to 1.77 Kg Cr VI coming on the market through this route between 2014 and 2029. Although Cr VI (which may possibly be present in a portion of the EPACs to be placed on the market in the future) can have an impact on the environment, in most areas of concern impacts are assumed to be negligible. The decision of whether to keep EPACs in the scope of RoHS or to exclude them is expected to have a negligible impact on the number of EPACs to be placed on the market in the future if at all. This is further supported by the understanding that the costs of compliance were not significant enough for manufacturers to provide information to facilitate the exclusion of the product in question. Such possible costs are therefore subsequently not expected to have a significant impact on consumer costs. Consequently, the EPAC market share would not be expected to change as a result of RoHS. In the following areas, an impact as a result of inclusion or exclusion in RoHS is thus not expected:

- **Impacts on air quality** – as these would mainly be expected to change should the trend of sales of EPACs, or the trend of use, were expected to change. Neither of these is expected in light of possible changes to RoHS. A negligible or no effect is expected.
- **Impacts on energy consumption** – again, it is not expected that an impact would arise since market shares are not expected to change and this factor is tied to the amount of energy used for EPACs in the life cycle in comparison with alternative modes of transport. As the shares between vehicles used for transport is not expected to change, here too, a negligible or no effect is expected.
- **Impacts on renewable and non-renewable resources** – see Impacts on energy consumption above, explaining why a negligible or no effect is expected.
- **Waste production** – Here the possible impacts of Cr VI on the environment need to be discussed. For Option 1, in which EPACs shall remain in scope, it is assumed that EU manufacture is compliant whereas non EU manufacture may still have Cr VI in screws. In light of the 2019 transition period it is assumed that at worst, non EU manufactured EPACs would still bring a total quantity between 0.27 and 0.33 Kg Cr VI on the market between 2014 and 2019, in comparison with a total of 0.92 to 1.54 Kg in the case of an exclusion (Option 2) and assuming that Cr VI is not phased out of the metal plating industry³⁶.

³⁶ This calculation is based on the Colibi & Coliped report of 2013 which provides data for 2012. Results of the same estimation on the basis of the 2014 ZIV estimation are specified above.

This would mean that the Exclusion Option would have a negative environmental impact in relation with a Net quantity of 0.66-1.21 Kg Cr VI, placed on the market in the course of 15 years. This quantity would end-up in the waste stream at the end-of life, and it can be assumed that only a fraction of it would end up in the environment. In this regard a 2008 guidance document of OSHA³⁷ specifies that “Employees in the metal recycling industry can be exposed to hexavalent chromium when chromium-containing materials are heated such as during melting or welding of chromium alloys such as stainless steel or a substrate with chromium protective coating”. Ecoinvent data³⁸ concerning possible emissions of chromium from the recycling of scrap iron in EU recycling plants, specifies that a 0.0012 gr of chromium emissions are expected from the recycling of 1 kg steel (chromium steel).

- **Impacts on noise emission** – though EPACs produce very little noise and could be compared with alternative modes of transport to clarify possible impacts to noise, an impact is not expected. The market share of various transport modes is not expected to change as a result of including or excluding bicycles from the scope of RoHS.

To conclude, in terms of environmental impacts, the only area where differences are expected between the two options is tied with the amount of RoHS substances that shall be placed on the market and thus come into the waste stream, should EPACs be excluded from RoHS. In this regard, it needs to be said that the information concerning RoHS conformity of EPACs at present has a degree of uncertainty. Though manufacturers are confident that EU manufactured EPACs are compliant, there is still a possibility that substances exist in some components arriving from non-EU countries. This uncertainty is mainly relevant for non-electric components, since for the electric components it is assumed that suppliers will have transitioned in light of production for other RoHS regulated products. Additionally, concerning the example calculated for Cr VI, it needs to be said that elimination of Cr VI in this application is assumed possible, as the RoHS Annexes do not contain exemptions that would serve such applications.

2.8.3 Economic impacts

There is no collection of EPAC data at a European level. The COLIBI and COLIPED data have been used in this section as a basis for estimation, with some use of German data to enable extrapolations from Germany to the EU. Approximately 20 million bicycles were sold in the EU27 in 2012, almost 4 million of which were sold in Germany. In 2012 approximately 854,000 EPACs were placed on the EU market by Colibi & Coliped members, which correspond to about 85% of the EU market³⁹. According to

³⁷ OSHA (2008), Guidance for the Identification and Control of Safety and Health Hazards in Metal Scrap Recycling Occupational Safety and Health Administration, U.S. Department of Labor, OSHA Publication 3348-05, pg. 20.

³⁸ Based on Ecoinvent (2009), Life Cycle Inventories of Metals, Final report ecoinvent data v2.1, prepared by Swiss Centre for LCI, Empa – TSL, Vo. 10

³⁹ Op. cit. COLIBI & COLIPED (2013)

VSF⁴⁰, in 2012 the turnover of the German retail bicycle industry amounted to € 5 billion. Extrapolated for the EU27 figure, this is estimated to be around € 24,860 million for 85% of the EU market which would mean that the total EU turnover is slightly over €29 billion. In this context, around 20,526 individuals are employed in 85% of the EU bicycle industry (or over 24 thousand extrapolated for the complete industry).

The EPAC market is described by stakeholders to have a steady growth, expected to be between 5 to 10% over the coming years⁴¹. This estimation was made at a time in which RoHS compliance was presumed achieved in the EU manufacture and possibly also beyond, and under the assumption that EPACs shall remain in scope. In 2012, the average retail price for an EPACs in Germany in 2012 was € 1,975, whereas the average price of a premium grade EPAC was € 2,517⁴².

In light of the understanding that the EU EPAC industry has achieved compliance, RoHS 2 should affect all EPAC makers in the EU equally, which means that no competitive pressures within the European Union should be expected. However, it is unclear to what degree this assumption is also true for manufactures outside the EU, which also includes manufactures of components used for bicycles assembled in the EU. In light of the low motivation of stakeholders to provide further data, it is assumed that here too, compliance is underway, in light of the current understanding that EPACs are to remain in scope. For this reason, it is also assumed that the cost of compliance, from a technical perspective, has not been substantial. The various economic impact indicators have been analysed against this background:

- **Impacts to market structure** – The EPAC industry is understood for the most part to already be RoHS compliant. No information was made available as to possible impacts in this regard, despite recurring inquiries by the consultants as well as by a representative of the industry. Though inquiries clarified that compliance had been achieved, also implying the compliance of components used in EU assembly, no mention of the significance of costs of compliance was made. It is thus assumed that such impacts have already occurred for the most part, and that they were not significant enough for industry to communicate their magnitude as an indication that additional impacts were still expected. The input provided from ZIV also clarifies that manufacture of EPACs and conventional bicycles is performed in separate batches in light of the differing properties that the vehicles need to have. Thus, even where compliance is still to be achieved, this is not expected to have an impact on the manufacture of conventional bicycles. It is thus concluded that no changes to market structure are expected as a consequence of the decision to include or exclude EPACs from the scope of RoHS, neither in terms of the general market share of the bicycle industry nor in terms of the conventional and EPAC shares. Should any changes occur, it would be as a consequence of changes in non-EU manu-

⁴⁰ Op. cit. VSF (2012)

⁴¹ Interview held on 04.04.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

⁴² Op. cit. VSF (2012)

facture of EPACs and components, and is thus discussed in the analysis of “Impacts to Competition”.

- **Impacts to competition, including wider economic impacts** (trade beyond the EU) – As explained above, the main effort of compliance is understood to have been undertaken, especially where the EU market is concerned. It is also understood that the industry is aware that EPACs are at present in scope, and has been developing with this notion in mind. In this regard, even if the compliance of non-EU manufactured EPACs is still progressing, it is expected to have already been accomplished for the most part. This assumption is further supported by the understanding that the supply chain manufactures parts not only for EPACs but also for other EEE, and possibly also for vehicles covered by the EEE Directive. The current state of exemptions in both Directives suggests that substitution is possible if not already achieved. It is not envisioned that development of substitutes would be required neither that compliance should be complicated in terms of the time and costs required, in light of the lack of contradicting information from the EU industry. The only area where earlier information suggests that compliance is still forthcoming regards the use of screws containing Cr VI in light of plating processes. As no exemption exists for such articles, in both RoHS and the ELV Directive, should this area still require a compliance effort, an interchangeable substitute is assumed to be available and not to impact the non-EU industry in terms of compliance costs. Nonetheless, if non-EU manufacture were to exhibit a reduction in production capacity, it is assumed to be short termed and of a low magnitude. As the current non EU manufacture is responsible for 41% of the EPACs placed on the market, even if a 10% decrease were to be expected, this would translate to ~4% of the EU market share. Though impacts could be relevant for manufacturers of parts, the supply chain is assumed to be more resilient, as the EPAC industry is at present relatively small and it is assumed that manufacturers do not depend on it as a single source of income⁴³. To conclude, should any impacts occur, they would be associated with Option 1. Impacts on the non-EU EPAC manufacturing sector are assumed to be between 0-10% and to translate at most to a shift of ~4% of manufacture from non-EU to EU manufacturers. Such an impact would be short termed and is not expected to have any resonance beyond July 2019, as the market is assumed to be in last phases of compliance. In the manufacture of EPACs parts, impacts are estimated to be of a lower degree. As until this time, non-compliant products can still be placed on the market, it is doubtful if such an impact would indeed change the balance between EU and non EU manufacture.

⁴³ In this regard it is important to clarify that though pedelecs are the dominant type of electric bicycles sold in the EU, and possibly the only type that is not type approved, thus falling under the scope of RoHS, the Chinese market in contrast is dominated by electric bicycles which would need to be type approved in the EU. As such vehicles can reach higher velocities, it is not assumed that the manufacture of parts is exclusively mutual, further supporting the understanding that component suppliers supply parts for the production of other products and most plausibly also for other EEE.

- **Impacts on manufacturing costs** (EPACs /conventional bicycles) – As explained, it is understood that EU industry representatives did not find the future costs of compliance to be significant enough to communicate such severity, not to mention a range of possible costs. Though direct inquiries were made by the consultants and by a representative of the bicycle industry, further information was not returned in this regard. It is thus assumed that the impacts on the cost of manufacturing are negligible. In this regard it needs to be kept in mind that the EU industry claimed compliance as early as 2012 (BIOIS study). Early compliance may further be supported by the fact that in RoHS 1, it was not clear if EPACs were in scope or not, and Member States may have differed from one another in how this was interpreted in national legislation. This would mean that the industry would have begun the effort towards compliance before RoHS 2 came into force and indeed have achieved at least partial compliance, regardless of the new legislation on EU level. To conclude, costs of manufacture of both conventional bicycles and EPACs are not expected to differ between Option 1 and Option 2.
- **Impacts across the supply chain**
 - Impacts on suppliers and manufacturers of components – As explained above, the EU EPAC industry is understood to be compliant. This has been clarified for manufacture of bicycles and parts in the EU. Manufacturers who assemble EPACs in the EU also claimed that parts are already compliant, thus meaning that either compliance has been achieved by the component supply chain, or the need to comply with RoHS is still being communicated down the supply chain and could still result in some impact. In the absence of further information, it is understood that the EU manufacturers of EPACs and of components are compliant and that impacts could only be possible for non-EU manufacture which has been discussed in “Impacts to Competition” above. To conclude, differences between Option 1 and Option 2 are not expected.
 - Impacts on repair enterprises – Though the industry is understood to be compliant to a large degree, the current RoHS legislation may provide for some obstacles that may result in impacts on repair and secondary market operations. At present, RoHS legislation is interpreted not to allow for repair of non-compliant EPACs placed on the market between 2.1.2013 and 22.7.2019, with non-compliant cables and spare parts. This could mean that EPACs that are already on the market or that should come on to the market shortly could not be repaired if compliant parts are not interchangeable. However, as industry has not regarded this aspect, it must be assumed that in most cases EPACs were compliant to begin with (as claimed in the BIOIS report of 2012) or that repair with compliant parts should be feasible. In this regard, if Option 1 (Baseline) were to have some impacts in terms of the limited reparability of some EPACs, these impacts would be low as manufacturers have claimed compliance as early as 2012, and could still repair earlier models legally with non-compliant parts. On the other hand, repair operations may have some costs for training personnel, in the transition from non-compliant to compliant bicycles. A further possibility

is that such enterprises would have a burden in terms of needing to have stock for repairing both compliant and non-compliant bicycles. As EPACs ⁴⁴ have been said to have a service life of 5 to 7 years, such impacts are also expected to become less relevant towards 2019, 7 years after when EPACs were claimed to be compliant. Thus should costs for repair enterprises occur, they are mainly relevant for training and the burden of providing repair operations for both compliant and non-compliant EPACs in the following few years. These costs would be relevant for Option 1, but are assumed to be small to negligible and to only be relevant over the next few years if at all.

- Impacts on secondary market operations (renting and leasing enterprises) – In the case of secondary market operations, individual sales between private individuals are understood to be beyond the scope of analysis, as it would not be feasible to enforce RoHS compliance in such transactions. As for leasing and renting operations, as EPACs are understood to be compliant since 2012, even if they were used by such operations for the duration of their full service life (5 to 7 years), it can still be assumed that by the time the 2019 transition period would apply, that non-compliant EPACs would no longer be circulated by such enterprises. If any impacts should incur in the transition between non-compliant to compliant models, they are thus understood to be short termed and to have already occurred in part. Thus any possible impacts relevant for Option 1 would be negligible.
- **Possible Internal Market Distortions (enterprises dependant on EPAC production)** - A representative of ZIV has stated that 95% of bicycle manufacturers produce both EPACs and conventional bicycles. It is also understood that most retailers sell both bicycle types, often providing repair operations for both, though it is possible that in some cases services could be outsourced to other firms. It appears that as EPACs at present represent at most 15% of the bicycle market share of (stated for Germany by ZIV, which is understood to be the EU leader in terms of EPAC sales at present), very few if any enterprises would be completely dependent on EPACs for their operations. In any case, even if this were the case, impacts to the sector do not seem to be expected as a result of inclusion or exclusion from RoHS. Thus it is assumed that Option 1 and 2 shall not differ from each other in this regard.
- **Possible Impacts on Consumers** – As it appears that the costs of compliance are insignificant, changes in the consumer price of EPACs is not anticipated to be affected by the transition to compliance. Furthermore, since it is understood that compliance has been achieved to a great degree, there does not seem to be a risk of a change in the ability of manufacturers to supply EPACs for the EU market. Against this background, it is not expected that the need for

⁴⁴ Op. cit. BIOIS (2012)

EPACs to become RoHS compliant would have a direct impact on the consumer's choice or on prices of products.

To conclude, economic impacts may occur in some areas, as a result of the inclusion or exclusion of EPACS in the scope of RoHS. However, as the compliance of EPACS has been claimed by industry as early as 2012, such impacts are expected to be negligible.

In terms of impacts to competition, should any impacts occur, they would be associated with Option 1, and affect the non-EU EPAC manufacturing sector at a rate of 0-10%, shifting at most ~4% of manufacture from non-EU to EU manufacturers. Manufacturers of components would be affected to a lower degree if at all. As such impacts are expected if at all before July 2019, they would probably not amount to an actual affect, as placing non-compliant products on the market is still allowed. Furthermore, the main affect should be expressed in a shift of business between manufacturers, and thus would not amount to a loss of turnover but rather a change in its distribution.

In terms of impacts on repair enterprises, in Option 1 some costs may be tied with training of personnel and with retaining repair services for all models in the transition period between non-compliant to compliant models. These impacts are also expected to be short termed and small in magnitude in light of the end of the transition period in 2019 and the assumed compliance of most products.

As it has repeatedly stated, that EPAC compliance has been achieved, these possible impacts are expected to be negligible and would probably also have occurred at least in part at an earlier stage of achieving compliance.

2.8.4 Social impacts

Concerning social impacts, it is assumed that both impacts on employment and impacts on consumers would be sensitive to changes in the number of EPACs to come onto the market as well as to shifts between the share of EU and none EU manufacture.

EPACs manufactured in the EU are understood to already be RoHS compliant, whereas the non-EU manufacture is understood to be close to conformity. The lack of statements claiming that the costs of compliance are, or have been significant, further suggest that even where some costs are still to be incurred to allow for compliance, this shall not be significant.

Against this background the need to become compliant with RoHS by 2019 is not anticipated to create a significant change in the various market trends. It is possible that the EPAC sector growth shall change and become more moderate over the coming years, however this would unlikely be as a result of RoHS conformity requirements.

As for possible shifts of manufacture between EU and non-EU countries, as the RoHS restrictions apply to all products placed on the market, the place of manufacture is not expected to be impacted by the need for conformity. Regardless of if an EPAC, or its parts, are to be manufactured in the EU or elsewhere, all parts will need to conform and thus affect the manufacturing enterprises equally, regardless of location.

The social indicators are thus analysed with this background in mind:

- **Impacts on employment** – As explained, though shifts may occur in the manufacture of EPACs and EPAC components between EU manufacturers and non-EU manufacturers, it is doubtful if the RoHS compliance requirements shall have much of an influence on such changes. Though one could argue that the EU manufacture has already reached conformity, whereas the non-EU manufacture may need further time, it is assumed that both markets shall be in line with the Directive before the 2019 transition period arrives. Thus even if the need to become compliant would result in more intensive employment in some non-EU enterprises, this change is expected to be a short term one (at most 5 years remain before the 22nd July 2019 deadline), which would have negligible impacts on employment of some enterprises in non-EU countries, if at all. As this this could lead to a temporary shift of business from non-compliant to compliant manufacturers, it is to be considered a distributional affect and shall not have an actual impact on the comparison of options.
- **Impacts on consumers** – As explained above, it is not expected that the need for EPACs to become RoHS compliant is to have a direct impact on the consumer's choice or on prices of products. Assuming that the cost and supply factors are indeed not affected by the need of EPACs to become compliant, it is subsequently assumed that compliance shall further not impact consumers decision to purchase EPACs and as a result cause a shift to the use of other (potentially higher impact) modes of transport.
- **Health** – The most direct health issue resulting from the manufacture of EPACs is assumed to be tied with applications where RoHS materials are still applied. As compliance is explained to have been achieved, these health impacts are for the most part to have occurred in the past and thus fall beyond the time scope of the analysis. As at present it seems that the only area of relevance is in the manufacture of Cr VI plated screws, these impacts would be expected in the supply chain and are thus considered to be indirect. In this regard, an OSHA guidance document clarifies that “The major illnesses associated with occupational exposure to hexavalent chromium are lung cancer, nasal septum ulcerations and perforations, asthma, skin ulcerations and allergic and irritant contact dermatitis”.⁴⁵ Substitutes are expected to be available and “drop-in” (interchangeable), however as the screw industry is expected to serve further clients and as the expected remaining non-compliant part of the EPAC sector is not expected to be substantial in terms of their business, it is doubtful if RoHS compliance would significantly change health impacts associated with the Cr VI plating of screws. Instead, such health impacts would continue to occur at a comparable rate, but would just no longer be associated with EPACs. In this sense, an absolute change of impact is not expected and should not be taken into consideration in the analysis of the options.

⁴⁵ Op. cit. OSHA (2008)

To conclude, social impacts are not expected to occur as a result of the inclusion or exclusion of EPACs in the scope of RoHS. As the supply of EPACs is assumed not to be affected by changes associated with RoHS (quantity or price), neither employment nor consumer surplus are expected to be impacted by either of the scenarios. As for health impacts, a quantifiable change in the health of workers in the Cr VI plating industry is not expected but only a shift in its association with actual products, thus it should not be considered in the comparison of options.

2.9 Comparison of options

While excluding EPACs from the scope of RoHS 2 is not expected to lead to substantial impacts, their inclusion in the scope is also not expected to result in significant costs. The results of the assessment of the various identified indicators relevant to environmental, economic and social impacts are summarised in Table 2-5 below.

Table 2-5: Comparison of options

Impact indicators		Option 1: Business as usual – EPACs to remain in scope of RoHS	Option 2: Exclusion of EPACs from the scope of RoHS
Environmental indicators			
Impacts on air quality		=	=
Impacts on energy consumption		=	=
Renewable and non-renewable resources		=	=
Waste – production, treatment and recycling		+	=
Noise emissions		=	=
Economic indicators			
Impacts to market structure		=	=
Impacts to competition, including wider economic impacts (trade beyond the EU)		=/-	=
Impacts to manufacturing costs (EPACs / conventional bicycles)		=	=
Impacts across the supply chain, repair enterprises, secondary market operations	Impacts on suppliers and manufacturers of components	=	=
	Impacts on repair enterprises	=/-	=
	Impacts on secondary market operations	=	=
Possible internal market distortions (enterprises dependant on EPACs production; retailers)		=	=
Possible impacts on consumers (product quality and availability)		=	=

Impact indicators	Option 1: Business as usual – EPACs to remain in scope of RoHS	Option 2: Exclusion of EPACs from the scope of RoHS
Social indicators		
Impacts on employment	=	=
Impacts on consumers shift away from motorised vehicles to EPACs	=	=
Impacts on health	= (health impacts shall continue to occur, regardless if the Cr VI plated screws are used in the EPAC industry or elsewhere)	=

In relation to the overall policy objective of RoHS 2, namely “to contribute to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste *EEE*”⁴⁶, the discussion above shows that including EPACs in RoHS 2 may have a small contribution to this objective, while only negligible costs may be expected in a few areas. In light of the understanding that compliance has occurred for the most part, it is assumed that all impacts shall be of low magnitude and short termed and may have in part already occurred. As the EPAC industry is not expected to have significant impacts on the conventional bicycle industry, nor is a shift in consumers likeliness to acquire EPACs expected in light of the decision to include or exclude EPACs in scope, there appears to be no reason to change the status of EPACs in terms of being included in the scope of RoHS.

2.10 Recommendation

Based on this assessment, it is recommended to leave EPACs in the scope of the directive.

⁴⁶ 2011/65/EU, Article 1

2.11 References

- BIOIS (2012) BIO Intelligence Service (2012), Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive, Final Report prepared in collaboration with ERA Technology for the European Commission, DG ENV, Retrieved 20.01.2014 from:
http://rohs.biois.com/documents/RoHS_II_IA_Final_Report.pdf
- Colibi & Coliped (2013) Colibi & Coliped (2013), European Bicycle Market, 2013 Edition, Industry & Market Profile (2012 statistics), available under:
<http://www.colibi.com/docs/issuu/European%20Bicycle%20Market%20&%20Industry%20Profile%20-%20Edition%202013.pdf>
- Ecoinvent (2009) Ecoinvent (2009), Life Cycle Inventories of Metals, Final report ecoinvent data v2.1, prepared by Swiss Centre for LCI, Empa – TSL, Vo. 10
- EU COM (2013) European Commission (2013), Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on End-of Life Vehicles (ELV), originally published in OJ L 269, 21.10.2000, p. 34), last consolidated version from 1.06.2013
- KEMI (2014) Swedish Chemicals Agency – KEMI (2014), contribution of Swedish Chemicals Agency (KEMI) to stakeholder consultation concerning the scope review of the RoHS Directive, submitted on 10.03.2014, available under:
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_Keml_comments_to_SC_RoHS_2014_1_Scope_review.pdf
- OSHA (2008) Occupational Safety and Health Administration – OSHA (2008), Guidance for the Identification and Control of Safety and Health Hazards in Metal Scrap Recycling Occupational Safety and Health Administration, U.S. Department of Labor, OSHA Publication 3348-05, pg. 20.
- VSF (2012) VSF (2012), Die wirtschaftliche Bedeutung der Fahrradwirtschaft in Deutschland, prepared by Albert Herresthal, VSF e.V., for the Vivavelo press conference held in Berlin on 23.02.2012.
- Interviews Interview held on 04.04.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

Interview held on 20.05.2014 with Siegfried Neuberger, Director of Zweirad-Industrie-Verband e.V.

3.0 Input for European Commission impact assessment on possible changes to Articles 2(2), 4(3) and 4(4)

3.1 Executive summary

Article 2(2) of the current RoHS regulation, is the only Article addressing EEE from Cat. 1-7, 10 and 11 (here after EEE newly in scope). Based on its contents, non-compliant EEE can be made available until 22 July 2019, after which further circulation of products placed on the market before this date is no longer allowed. Furthermore, no provisions are made for the repair of such EEE, effectively meaning that repair with non-compliant spare parts or cables is not allowed – neither before mid-2019 nor after. This means that such devices shall reach the end-of-life once a malfunction occurs that cannot be repaired with compliant parts. Article 2(2) also applies to Cat. 8 & 9 EEE, meaning that non-compliant products placed on the market before the Article 4(3) dates (mid-2014/2016/2017) is only allowed secondary market operations until mid-2019.

The impacts of enforcing these legal requirements may result in costs which significantly outweigh the benefits of its implementation. Such costs include costs for the environment, where products reach the end of their service life early, as well as costs for enterprises, where the value of products is affected in light of the limitations to circulation and reparability.

To establish the implications of implementing various changes to the RoHS legal text, a number of possible policy options were proposed. These addressed the aspects of secondary market operations and reparability of non-compliant EEE placed on the market before the relevant compliance deadlines, as well as proposing an earlier compliance deadline in one scenario. These options were assessed and compared in terms of possible impacts expected to incur on the environment, on the economy and on society. As in all evaluated policy options, all EEE placed on the market after 22 July 2019 would need to be compliant, only the differences in impacts between each proposed option and the baseline scenario of the current RoHS legal text were reviewed.

It was concluded that adding a provision in Article 4(4), allowing the use of non-compliant spare parts in EEE newly in scope would be beneficial, regardless of any other changes to be implemented in the RoHS legal text. Furthermore, to resolve the possible impacts tied with the limited secondary market operations prescribed in Article 2(2), it was concluded that a specific date should be provided for the compliance of EEE newly in scope in Article 4(3). Two possible dates were considered – the current date (22 July 2019) specified in Article 2(2) and an earlier date (22 July 2017), as well as a solution only resolving uncertainties for Cat. 8 & 9 products. Since the initial evaluation of options did not allow clarifying in which of the first two options a higher net benefit was to be expected, a further examination of a number of product examples was performed. These product examples referred to applications with integrated lighting, equipment with an internal combustion engine, gardening equipment, and toys.

This further evaluation demonstrated that in most cases an earlier compliance date would result in a lower cost/benefit ratio, with some product groups (applications with integrated lighting) being indifferent. Thus incorporation of Article 2(2) into Article 4(3) with 22 July 2019 as the compliance date was found to be the optimal solution in this regard.

3.2 Procedural issues

In the course of the recast of the RoHS 1 Directive 2002/95/EC, launched by the EU COM in 2008, a first proposal for the RoHS recast (COM (2008) 809 final) was published in December 2008, accompanied by an impact assessment. Various changes were made to this proposal by the Council and the Parliament before adoption on 8 June 2011 as Directive 2011/65/EU. These changes, including significant changes to the scope of application of the Directive, were not subject to the initial impact assessment provided in 2008, though included in the legal text of Directive 2011/65/EU.

Immediately after the adoption of RoHS 2, the Commission launched a study⁴⁷ for a screening of the un-assessed scope related changes from the 2008 Commission proposal to the final RoHS 2 text. Among others, the study identified the following different types of scope related problems:

- RoHS restrictions apply to products when they are placed on the market. Once on the market, they may be circulated without further restrictions. However, only compliant products (at the time they are placed on the market) can benefit from this protection from retroactive measures. In this context, the Article 2(2) transition period has significant unintended retroactive side-effects on non-compliant EEE newly in scope, placed on the market between 2 January 2013 and 22 July 2019, regarding secondary market operations.
- Article 4(4) lists spare part provisions for the old product categories and for medical devices and monitoring and control instruments. Products containing RoHS restricted substances, placed on the market before coming into scope, can still be repaired with the original, non-compliant spare parts. However, Article 4(4) does not provide a spare parts provision for products newly in scope, other those falling under Cat. 8 and Cat. 9, meaning that products falling within these categories, placed on the market lawfully until 22 July 2019, cannot be repaired with non-compliant parts.

To further substantiate the results of the BIOIS study, by providing additional input to the Commission Impact Assessment for the review of the scope of provisions of the RoHS 2 Directive pursuant to Article 24(1), the current project was launched by the EU COM.

⁴⁷ BIO Intelligence Service (BIOIS) (2012), *Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive*, Final Report prepared in collaboration with ERA Technology for the European Commission, DG ENV, retrieved 20.01.2014 from: http://rohs.biois.com/documents/RoHS_II_IA_Final_Report.pdf

In the course of the current project, a stakeholder consultation⁴⁸ was held between 13 December 2013 and 10 March 2014. Stakeholders were provided with a short summary of the aim of the project and the scenarios that would be investigated, as well as with a questionnaire outlining the main areas where information was needed. Various manufacturers of EEE participated in this exercise, providing information and data as to possible impacts of the current status of products addressed by Article 2(2). Contributions made through the stakeholder consultation are available on the RoHS Evaluation website under:

<http://rohs.exemptions.oeko.info/index.php?id=210>.

A summary of stakeholder contributions is provided in Appendix A.8.O. Further correspondence was initiated with these stakeholders to clarify open issues and see if additional data could be provided. Along with the review of publicly available information, the results of this consultation have provided a basis for the assessment detailed below.

3.3 Problem definition and background

Article 24(1) of the RoHS Directive 1 states that:

“No later than 22 July 2014 the Commission shall examine the need to amend the scope of this Directive in respect of the EEE referred to in Article 2, and shall present a report thereon to the European Parliament and the Council accompanied by a legislative proposal, if appropriate, with respect to any additional exclusions related to that EEE.”

In 2008, the European Commission launched the recast of the RoHS 1 Directive 2002/95/EC in order to strengthen and adapt the existing law. A proposal for the RoHS recast (COM (2008) 809 final) was published in December 2008, accompanied by an impact assessment. This Commission proposal introduced new definitions and extended the original RoHS 1 scope to medical devices and monitoring and control instruments.

Substantial changes were made to this proposal by the Council and the Parliament before adoption on 8 June 2011. One of the significant changes included the introduction of a product category *"other electrical or electronic equipment – EEE"* (i.e. the introduction of an *"open scope"*⁴⁹ making the Directive applicable to all EEE) and a *broader interpretation of EEE* as a result of a new definition of the dependency⁵⁰ on

⁴⁸ For further information see consultation page under: <http://rohs.exemptions.oeko.info/index.php?id=208> and electric bicycles section under: <http://rohs.exemptions.oeko.info/index.php?id=209>

⁴⁹ Listed in Annex I of Directive 2011/65/EU as Category 11.

⁵⁰ Defined in Article 3 of Directive 2011/65/EU as follows:

“(1) ‘electrical and electronic equipment’ or ‘EEE’ means equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1 000 volts for alternating current and 1 500 volts for direct current;

electricity. In practice, these two changes have extended the scope of products that are required to comply with the RoHS Directive substance restrictions. Products that were previously not under the scope of RoHS 1, but that are now required to comply with the substance restrictions are from herein after described as “products newly in scope”.

RoHS 2 foresees a transitional arrangement until 22 July 2019 for electrical and electronic equipment that was formerly outside the scope of RoHS 1 but that is now in scope in the form of Article 2(2). The transition period does not change the legal status of these products as non-compliant. It only means that products newly in scope that do not comply with the substance restrictions may not be placed or circulated on the EU market beyond 22nd July 2019. The market access provided in Article 2(2) is relevant only for products that must newly abide to the Article 4(1) restrictions, i.e., for products falling under categories 8, 9 and 11 and for products newly included in the scope of categories 1-7 and 10 in light of the new interpretation of the dependency on electricity in the EEE definition.

In general, RoHS restrictions apply to products when they are “placed” on the market. If a product was compliant at the time it was placed on the market, it may thereafter be circulated without further restrictions. However, only compliant products (at the time they are placed on the market) can benefit from this protection from retroactive measures. In this context, the Article 2(2) transition period has a number of retroactive side-effects:

- As a consequence of the current wording, non-compliant⁵¹ products that have been placed on the market⁵² between January 2013 and July 2019, are not allowed any secondary market operations after 22 July 2019. This is understood to affect all products newly in scope, including non-compliant medical devices and monitoring and control instruments (EEE categories 8 and 9) placed on the market before their specific Article 4(3) compliance dates (22 July 2014/2016/2017). This effectively means that such articles cannot be circulated after mid-2019 on the EU market, and thus secondary market operations shall need to be discontinued, regardless of the age and functionality of a device.
- A further aspect, of RoHS compliance of EEE newly in scope, is related to its reparability. Article 4(4) of RoHS permits the use of non-compliant spare parts and cables for the repair, the reuse, the updating of functionalities or upgrading of capacity, of EEE falling under the conditions of its sub-items. For exam-

(2) for the purposes of point 1, ‘dependent’ means, with regard to EEE, needing electric currents or electromagnetic fields to fulfil at least one intended function;”

⁵¹ A product is considered compliant if it either a) does not contain any RoHS restricted substances above the %/weight specified in Annex II of the Directive or b) if the remaining use of RoHS restricted substances in the relevant components is allowed through an existing exemption listed in Annex III of the Directive, at the time the end-product is placed on the EU market.

⁵² According to Article 3(12) of the RoHS 2 Directive, “‘placing on the market’ means making available an EEE on the Union market for the first time.

ple, Cat. 8 and Cat. 9 may benefit from this provision as they are specified in Articles 4(4)(b-e). This is based on the principle that in most cases the extension of the EEE life-time is both economically and ecologically desirable. However, Article 4(4) does not provide a spare parts provision for products newly in scope, other EEE covered by Cat. 8 and Cat. 9. In other words, other products newly in scope, placed on the market lawfully until July 2019, cannot be repaired unless spare parts are compliant with the requirements of the RoHS directive. This effectively means that repair with non-compliant spare parts or cables is forbidden – both before mid-2019 and after, and some devices may reach the end-of-life before the average product service life, if a malfunction occurs that cannot be repaired with compliant parts.

There are concerns that the impacts of enforcing these legal requirements may result in costs which significantly outweigh the benefits of their implementation. Such costs include costs for the environment, where products reach the end of their service life early, as well as costs for enterprises, where the value of products is affected in light of the limitations to circulation and reparability.

3.3.1 Definitions

Against the background explained above, a number product properties have been identified which may lead to different impacts associated with their regulation under RoHS as a consequence of Article 2(2) and the current formulation of Articles 4(3) and 4(4). These properties are of importance for the following assessment and are specified below:

- Product service life – below 3 years (short) or above 3 years (long);
- Reparability;
- Subject to secondary market operations (such as renting, leasing, etc.).

The following matrix of these properties has thus been developed to clarify the various product groups that should be reviewed in the course of the evaluation. Examples and clarifications are noted within the matrix (Table 3-1).

Table 3-1: Matrix for defining product groups with varying properties relevant for the evaluation

	Short life (below 3 years)	Long life (above 3 years)
Repairable	Empty group – repair of short life products assumed not economically feasible.	Products for which the regulation of reparability could affect impacts in different scenarios. For example*: articles with integrated lighting Resale expected mainly between private individuals and thus tracking and enforcing of RoHS compliance would not be feasible and impacts relevant for secondary market operations disregarded.

	Short life (below 3 years)	Long life (above 3 years)
Subject to secondary market operations (but non-repairable)	<p>Possibly relevant for specific products, though most assumed not to fall under “EEE newly in scope” (e.g. Consumer electronics already in scope) and as re-design cycles are shorter meaning that some products will be compliant before 2019 deadline anyway. Short life products expected to be in service of secondary market operators for shorter periods as use is more intensive (e.g., in use for one year before sale to private consumers). Operators are assumed to avoid acquiring new products a year before compliance is required, since return on investment would be impacted.</p> <p>Example is lacking*. In light of assumed low relevance (small group of applicability where impacts to be expected), group not to be comprehensively evaluated.</p>	<p>EEE would commonly be operated through renting and leasing operations, thus being susceptible to possible impacts on the allowed circulation of products after they have initially been placed on the EU market.</p> <p>Example is lacking* and it is further assumed that this may be an empty group, as equipment with longer service periods will usually also be repairable.</p>
Both repairable and subject to secondary market operations	<p>Empty group – repair of short life products assumed not economically feasible.</p>	<p>EEE susceptible to possible impacts in terms of limited reparability and limited circulation of products after they have initially been placed on the EU market. For example*: equipment with an internal combustion engine such as generating sets and garden equipment.</p>
None of the above	<p>Possibly relevant for specific products, though most assumed not to fall under “EEE newly in scope” (e.g. Consumer electronics already in scope). As reparability and secondary market operations are irrelevant, impacts may only be relevant if the 2019 deadline were to change, as in all other options, products can still be placed on the market for the first time. In light of short design cycles, it is assumed that at least some products shall be compliant before 2019, thus reducing the magnitude of possible costs even more. As example is lacking*, group not to be comprehensively evaluated.</p>	<p>Products for which the regulation of reparability could affect impacts in different scenarios. For example*: toys.</p> <p>Resale expected mainly between private individuals or through charity organisations where enforcing compliance is not straightforward – this shall be discussed briefly with the main evaluation referring to other properties.</p>

*Note: *Examples have been specified based information provided in stakeholder contributions, which have been as a method for identifying what products may fall under “EEE newly in scope” as well as for identifying product relevant properties and initial areas where impacts are foreseen in the various policy options to be reviewed.*

3.4 Objectives

The objective of both, the RoHS recast proposal (COM (2008) 809 final) as well as RoHS 2 (2011/65/EU) is to contribute *“to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste EEE”*.⁵³

The purpose of this project is to compare the impacts of implementation of the current Articles 2(2), 4(3) and 4(4) with impacts of possible scenarios in which these Articles are to be altered. It needs to be noted that the assessment has been performed on the basic understanding that the current scope of articles falling under the definition of EEE is to remain unchanged for this assessment. In this sense, the environmental benefits tied with the substitution and elimination of RoHS substances are envisioned to incur in all scenarios, though possibly requiring different periods of time for realisation. To this end, the assessment is to determine under what conditions the best relation between further costs and benefits might be expected.

Policy options are thus evaluated according to the ability to reach the above-mentioned overall objective of the RoHS Directive and in light of further costs and benefits associated with their implementation.

3.5 Policy options

The policy options analysed are defined as follows:

- **Option 1 (Baseline scenario):** The current formulation of Articles 2(2), 4(3) and 4(4) in the legal text of RoHS remains unchanged;
- **Option 2 (Cat. 8&9 scenario):** Amendment of Article 2(2) to exclude Category 8 and Category 9; This option shall include a short discussion of further areas where articles falling under other categories may have similarities that should be considered;
- **Option 3 (2019 scenario):** Incorporation of Article 2(2) into Article 4(3) with the 21 July 2019 as the compliance date, allowing secondary market operations for non-conforming products newly placed on the market before 22 July 2019;
- **Option 4 (2017 scenario):** Incorporation of Article 2(2) into Article 4(3) with the 21.7.2017 as compliance date, allowing secondary market operations for non-conforming products newly placed on the market before 22 July 2017;
- **Option 5 (Spare-part scenario):** The addition of a spare part provision for non-conforming products newly coming into scope and placed on the market before 22 July 2019 shall ensure reparability of such items, even where non-conforming spare parts are needed. This scenario shall be assessed in comparison with the current state of Article 4(4). Conclusions shall regard its applicability in conjunction with Options 1-4.

⁵³ 2011/65/EU, Article 1

In the analysis of the various scenarios, a number of impacts of the Baseline Option are understood to continue to apply, regardless of the proposed changes. This is a result of the general understanding that all products currently in the scope of RoHS⁵⁴ shall remain in the scope of the Directive. In light of the Article 2(2) transition period, it is understood that where compliance with the substance restrictions is not already possible, manufacturers are aware of the new requirements and the effort towards compliance has begun. The status of compliance of products in 2019 is thus considered achievable in all scenarios, whereas implications to this schedule stemming from the various scenarios shall be analysed to clarify where differences may occur and what their magnitude may be. In the following analysis of the Baseline scenario, a distinction is made between aspects where differences may occur and where aspects are assumed to remain unchanged.

3.5.1 The baseline

To establish the general situation of the EEE industry, statistical data from Eurostat⁵⁵, concerning the value of production, was collected for NACE code groups understood to fall in part (28) or in entirety (26, 27) under the scope of RoHS. The 5 years of most recent data (2008-2012), shows the value of production has remained similar in the EU 27 and in most individual countries, aside from a significant decrease in 2009 assumed to be tied to the financial crisis. In 2012 this value amounted to € 860.6 billion. Data on the contribution of EEE to the economy shows that the value of production has remained quite stable in its ratio to GDP, aside from the 2009 decrease, amounting to around 6.66% in 2012. It is difficult to distinguish between EEE and EEE newly in scope in terms of value and influence on the market, as for some products, certain models may fall under the old scope and others under the new, with no distinction in terms of activity classification. In the case of machinery, some equipment may fall under large scale exclusions with others remaining in scope. Against this background, further attempts to quantify this market have not been made. To provide some insight as to the magnitude of costs, a few examples shall be elaborated on, where stakeholders have confirmed that products are newly in scope and partial data was available. To this end, a few key assumptions are detailed below, that are in the background of this assessment, followed by an explanation of the key impacts on the environment, on the economy and on society:

- In cases of similar products, some of which were in the scope of RoHS 1 and some of which are newly in scope, it is assumed that similarities shall facilitate compliance and that to some degree compliance is already achieved to avoid past costs related to multiple production lines.
- A multitude of exemptions are already available in Annex III of the Directive to all categories and in Annex IV for categories 8 & 9. As in most cases products

⁵⁴ Aside from Pipe Organs and E-bikes that are being discussed in parallel concerning possible exclusions from scope.

⁵⁵ EUROSTAT Statistics on the production of manufactured goods for the years 2008-2012, available under http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel and data on "GDP and main components – Current prices [nama_gdp_c]" for the years 2008-2012

are based on similar applications and components, these exemptions may already cover a large part of compliance issues of products coming into scope. Products that are already compliant in light of such exemptions would thus have no issues in terms of reparability and secondary market operations, as Article 2(2) loses relevance once the article is compliant when placed on the market. As some manufacturers see the 2019 date as the deadline for coming into scope, they may not be aware in such cases that products were entitled to CE marking in terms of RoHS conformity. This may create administration costs to clarify the status of articles in the future, and may also result in impacts where the awareness to such compliance is lacking. That said, it can be followed that the effort of requesting exemptions shall be focused on renewal and reformulation of existing exemptions (and possibly of old exemptions to allow redesign with available substitutes), to ensure that they address relevant products and the required timeline. Less effort is estimated to be relevant for new exemptions, in light of most products falling under categories already in scope or categories already in the midst of their compliance efforts (Cat. 8 & 9).

- As the differences are to be compared between the policy options, and the absolute costs and benefits shall not be quantified, it is assumed that most of these differences shall occur between now and the 2019 deadline. If manufacture is to change, it is mainly a result of compliance and thus costs can shift if deadlines change, but shall otherwise remain similar once all products are in scope. In this sense, the estimation shall regard the period between 2014 and 2019, unless specifically mentioned in cases where a shift of costs between stakeholders is expected (for example, costs and benefits shifting from EU manufacturers to non-EU manufacturers in light of a shift of the production of certain applications) and not just a change of the magnitude of costs (for example, all manufacturers to have higher costs for substituting lead in soldering applications).
- As it is assumed that where reparability and secondary market operations are concerned, the service life of the product plays a role, it was agreed with the EU COM that a service life of 3 years shall be the threshold for distinction between long and short life. It should be noted that shorter life products usually have shorter design cycles and are assumed to have less issues where substitution is concerned, in terms of loss of reliability. It is thus assumed that for such products, accomplishing compliance will need less time, possibly resulting in manufacturers achieving compliance for a larger range of short-life products ahead of the 2019 deadline.

The following sub-sections explain the main impacts that are understood to relate to the baseline Option. Impacts are explained to demonstrate what is expected under the present status, and to facilitate a qualitative comparison of the differences between the Baseline and other policy options. As the assessment is to focus on the differences between options, quantifying the impacts associated with the baseline on a more comprehensive basis is not required.

3.5.1.1 Environmental impacts

Impacts tied to reduction in use of RoHS substances – It is assumed that manufacturers have been aware of compliance deadlines as early as 2011 when RoHS 2 was published. In this respect, manufacturers are expected to already be progressing efforts towards compliance. Where compliance is not expected to be possible before the relevant date, it is assumed that manufacturers will attempt compliance through request of exemption. Assuming that arguments are to prove that exemption is justified on the basis of the criteria listed in Article 5(1)(a), an exemption could be granted. In this sense, where substitution in a specified application is not possible, exemptions would be granted. There may also be cases where some manufacturers are more developed than others, making the justification of an exemption less plausible. This process is understood to achieve the baseline situation in which all products brought on the market are either directly compliant (i.e., with the currently regulated RoHS Directive substances being eliminated), or permitted through the future approval of relevant exemptions. It is assumed that this shall provide a certain level of environmental benefit. Benefits are expected:

- In terms of reducing the use of hazardous substances. This is assumed to be achieved for the most part by 2019. In cases where further exemptions are to be granted for the use of RoHS substances in certain applications, further benefits would incur in the years after 2019, once substitutes are developed and such exemptions become obsolete.
- In terms of reducing emissions of hazardous substances through the life cycle. Concerning manufacture this is also to be achieved for the most part before 2019, whereas in the ‘use phase’, and more importantly in the ‘end-of-life phase’, such benefits shall incur at a later period when products reach end of life.

Impacts tied to early end-of-life of EEE that cannot be repaired – As explained above, the current legal text is understood not to allow repair of EEE newly in scope, placed on the market after 2 January 2013, with non-compliant cables and spare parts. Such products that shall encounter a malfunction could not be repaired, and may reach end-of life early. As this point is mainly relevant for products with a service life above 3 years (as in other cases reparability is considered less feasible), only long-life products would be expected to have significant impacts in this regard. Where the repair is prohibited, malfunctions to occur towards the natural expected end-of life of the product would have a limited impact in this regard, as the otherwise extendable lifetime shall only be somewhat shorter. Based on stakeholder contributions (see assessment of example products in Section 3.5.3), products with longer service life that fall under “EEE newly in scope”, have been stated to have service lives as long as 25 years, with 10 years representing the average. In this sense, in the baseline, such non-compliant products could be placed on the market as late as 21 July 2019. Impacts from malfunctions occurring during the 8th service year, for instance, that could not be fixed with compliant parts are assumed to have a lower impact. In this regard, such impacts would still be relevant in mid-2027.

Impacts tied to EEE reaching end of market life early (secondary market operation limitation) – It is understood that the impacts tied with the limitation of secondary market operations are mainly relevant for renting and leasing operators as well as for

sales operated by dealers of second-hand and refurbished equipment. Renting and leasing of EEE newly in scope is assumed more relevant for products with long service life (i.e., an average of 10 years) and can be operated for private consumers or for industrial and medical consumers, with longer service lives being of higher relevance for the latter. Sales of second-hand equipment between private consumers are disregarded, as tracking such sales and enforcing the RoHS requirements is assumed unfeasible. Here too products may have longer and shorter service lives.

Dealers of such EEE are expected to stop acquiring non-compliant products that they do not expect to be able to “get off their hands” before the 2019 deadline. In this sense, impacts would incur to the earlier owner (consumers or commercial users) when operators see such sales as uncertain. For most products this could be expected as late as 2018, or even later, as a slow market would suggest that activity is not profitable for dealers.

Products sold to private consumers may be sold to other private consumers, despite RoHS restrictions. This means that such products could potentially remain in use till end-of-life, with a slightly higher administrative effort in terms of who can sell what.

In the commercial sector, however, it is assumed that most products would have to be off the market at latest in mid-2018, and possibly earlier, if sellers would seek to be able to get the full value of the sale. This would result in products being sold at lower prices or more likely to non-EU consumers. In this sense some costs could be incurred in terms of lower sales, a shift of products to external markets, as well as possibly higher administration costs to facilitate the change. In both cases, further use of functioning products is expected and impacts from early end-of-life are not expected. The possible sales to external markets would mean that more hazardous materials may end up in processing of end-of-life products in non-EU countries. Though this could be seen as a benefit for the EU environment, from a global perspective it is a change in distribution of environmental costs. It should also be noted that in the medical community, refurbishment and resale of parts for repair of operative equipment is common practice. An exemption has been approved in this regard and thus related costs are not to be taken into consideration⁵⁶.

Concerning renting and leasing activities, in the Baseline Option, it is assumed that operators of the relevant secondary market operations would slowly shift away from non-compliant products. In this case they would experience administrative costs in terms of becoming familiar with the Directive and establishing sufficient documentation from suppliers, but they are not expected to be subject to costs from a reduced market life. In some cases, where compliant products do not become available significantly in advance of the 2019 deadline, a possible second strategy could be to shift to equipment with a shorter service life so that the loss of value of the investment is reduced. In this case operators may lose a part of income and consumers may have a

⁵⁶ See Ex. 31 of Annex IV in the consolidated version of Directive 2011/65/EU. It should be noted that a similar exemption has been requested by manufacturers of electron microscopes of category 9 and is yet to be decided upon, for further information see evaluation page under <http://rohs.exemptions.oeko.info/index.php?id=206>.

loss in terms of limited supply of certain products or a change in terms of product properties. Furthermore, here too, operators may direct non-compliant products to external markets to avoid dealing with compliance issues. Although the degree to which these possibilities might occur in practice is somewhat speculative, environmental impacts would thus again not be expected to incur in terms of early end-of-life, but to be tied to a different distribution of waste-EEE (WEEE) and its related impacts. The shift of activity is expected more towards the 2019 deadline; consequently, the environmental impacts tied to end-of-life will thus be incurred later still, due to most products being long-life.

In cases of long-life products supplied to industry and to the medical community, the legal situation of products falling under category 8 and 9 is somewhat unclear as their mention in Articles 4(3) and 4(4) means that non-compliant products placed on the market before the July 2014/2016/2017 deadlines can be further circulated and a spare part provision is also in place. Nonetheless, there is concern that their mention in Article 2(2) may present a contradiction to the above, meaning that secondary market operations would be limited. As clarifying this aspect is understood to be background for Option 2 (Cat. 8 & 9 scenario) the above assumptions would be relevant for such products in the Baseline scenario to allow establishing the difference in impact.

Impacts tied to changes in manufacture of EEE – In this regard, it is understood that changes to manufacturing processes as a result of substitution would be expected in all options, whether or not compliance with the RoHS substance restrictions is required at an earlier or later date. Such impacts on manufacturing shall differ mainly in terms of distribution throughout time (in options where this is relevant), or on the geographical basis – i.e., where certain manufacturing practices are possibly shifted to non-EU countries (or vice versa). The latter is assumed less likely to have a significant affect, as RoHS does not regulate the manufacture of products but only their marketing in the EU. In this sense EU manufacturers could still produce non-compliant products for export, whereas all manufacturers exporting items to the EU would need to comply. If a certain practice is to change in light of compliance, only in some cases would manufacturers be assumed to change all manufacture to avoid multiple production lines. As it is assumed that many manufacturers may already manufacture products that are already in scope, such consideration would have been expected to have more of an impact when the majority of EEE came into the scope of RoHS 1.

3.5.1.2 Economic impacts

Impacts on manufacture (compliance) – As explained in part above, based on the deadlines provided for compliance, manufacturers shall be expected to implement efforts towards this requirement. In some areas this would result in further R&D activities to find substitutes and/or to integrate them in the redesign and manufacturing of products. Subsequently, where changes are needed to achieve compliance, costs would be relevant where substitution requires redesign and/or changes in material resources and/or changes to production lines or to abatement equipment. It is expected that many products will either have available substitute applications or available exemptions, respectively meaning that compliance would necessitate less research and testing of new substances, or compliance would be shifted to a later time (through a time limited exemption) when substitutes are found. As it can be assumed

that many applications are similar to those of products already regulated, in some cases compliance may have been achieved in the past, as it was less economic to manufacture both compliant and non-compliant articles. Thus it is expected that costs shall incur for compliance, but that these shall not be as severe as they were when RoHS 1 came into force, as to some degree, phase-out has occurred indirectly. Such costs are expected to be incurred starting once the effort is begun (as early as mid-2011, when the Directive was approved), and decreasing gradually as the compliance deadline arrives, with some costs incurring after the deadline subsequent to finding substitutes (in the case of possible exemptions). Additional costs are to be expected where reparability is limited, as this will require manufacture of more compliant articles to replace non-compliant ones that have malfunctioned. As repair of articles is relevant for certain products, regardless of their compliance, manufacture of parts shall have similar costs, affected only where the cost of compliant parts differs significantly from that of non-compliant parts. SMEs (small-medium enterprises), may have a heavier burden tied to compliance, as resources are limited, however in some cases this could also be developed into an advantage, as in small enterprises, promoting innovative change is sometimes easier in light of less developed hierarchical systems for approving such processes and as some small firms may even depend on such innovations for their development (e.g., start-ups; seed enterprises). In this sense, compliance may give some SMEs an “edge” and create benefits, while having a high price for others.

Distortions of internal market – If in areas where companies manufacture similar products which have been in scope and which are coming into scope benefits are envisioned, the case for firms who also manufacture non-regulated goods is different. In such cases the need for compliance of regulated articles may lead to costs for non-regulated manufacture, when components are similar and future manufacture of both compliant and non-compliant articles is not economically viable. In these cases enterprises shall either decide to establish compliance of all articles (potentially higher economic costs, but with environmental benefits), to out-source the manufacture of components of the product (creating a change to the distribution of activity and related costs between manufacturers and suppliers), or to abandon manufacture of RoHS regulated product altogether (resulting in a change to product portfolio as well as in less supply and/or variation of products for consumers). This shall result in costs only in some cases, since not all enterprises shall have such products in their portfolio; nevertheless, these costs should not be neglected. A possible example of relevance concerns products for which most of the portfolio is excluded through the large equipment exclusions in Article 2(4)(d and e) or through other exclusions available in Article 2(4). It should however be noted that such similarity will not always require adaptation of manufacture, as production lines may be separate to begin with and manufacture in separate batches may also allow differentiating between articles.⁵⁷

⁵⁷ This was understood to facilitate compliance of E-bikes, in the case of manufacture of electric bicycles and conventional bicycles, see assessment of Exclusion for E-bikes in Section 2.0 of this report.

Administrative costs of compliance – Costs are expected in this regard both for industry and for public authorities. Costs would be tied with training of personnel in light of new aspects of the Directive (updating of knowledge) or where new products come into scope requiring training of additional personnel. Costs will also occur associated with the process of exemptions (applications, evaluation and approval). Further costs will be associated with the general need to screen products for compliance. Further detail is provided below:

- **Industry.** From the administrative perspective, this would mean that the product portfolio would be screened for occurrence of RoHS substances and plans would be made to enable compliance, in time with the stipulated deadlines. Where non-compliant applications are found in self-manufactured components or in the supply chain, manufactures (or suppliers) would apply for exemptions. Once these were approved or denied, this would need to be communicated to the relevant units and supply chain in order to adapt manufacture to the required changes. The managing of the product portfolio also requires updating of product documentation regarding RoHS compliance, so that CE marks can be affixed to compliant products, facilitating the circulation of products. Furthermore all of these activities may require the training of personnel who then deal with such activities as part of their duties. An Arcadis & RPA study from 2008⁵⁸ performed a survey of industry regarding compliance with RoHS and found that past costs and future one-off administrative costs had amounted to a maximum of € 42.7 million per company, with an average of € 5.9 million and a weighted average of € 13.2 million. Future yearly administrative costs were estimated to amount to a maximum of € 4.7 million, with an average of € 265,500 and a weighted average of € 675,000. This was further explained to mean that below 0.001 and 1.233% (0.024% – weighted average) of turnover was relevant for past costs and future one-off costs, whereas between 0.0001 and 0.15% (0.014% – weighted average) of turnover was assumed to be needed for future yearly costs. It is assumed that future one-off costs could be lower, as for most companies, a large part of the product range is compliant and initial know-how of the processes has been established. Annual costs however would be expected to retain a similar rate, as they are tied with general administrative work such as documentation of compliance, and are not necessarily affected by the distribution of compliant and non-compliant products.
- **Public authorities.** National authorities are required to transition the Directive into national legislation. This has had costs adjacent to the adoption of the new Directive, but also has costs when exemptions and other amendments are approved and need to be updated. National authorities will also provide support to stakeholders with questions concerning compliance, meaning that time for training of personnel was needed when the Directive was approved and from time to time in light of updates. Further costs are relevant for repre-

⁵⁸ Arcadis Ecolas & RPA (2008), A Study on RoHS and WEEE Directives - Final Report, 06/11925, prepared for European Commission DG Enterprise and Industry, pg. 103, 110

sentatives who accompany the process of approval of exemption as well as for market surveillance of all products, where compliance is expected or where exemptions enable compliance. All of these will have had one-off costs when the Directive was approved (i.e., incurred costs) as well as running costs in light of needed updates and on-going activities. The bulk of costs is assumed not to have changed as RoHS activities were relevant once the first Directive was approved and other activities are on-going regardless of changes, though volume may change: fluctuations in costs may incur in times when more exemptions are filed for as well as when new product groups come into scope, requiring re-planning of market surveillance and possibly acquisition of new equipment to support such activities, where new applications are concerned.

Impacts on market structure – As RoHS affects manufacture evenly, in terms of EU and non-EU manufacture, it is not expected that significant impacts should incur as manufacture shall not be shifted elsewhere to avoid compliance costs. None the less, as explained above, in some cases manufacture of compliant components and niche technologies is focused in certain countries and may result in more activity for such facilities in the short term, in light of the effort of compliance of the next few years. Though this may have an impact on market structure, it is assumed to be rather low in magnitude as it regards specific types of applications.

Impacts on consumer – Impacts on consumers will be tied to changes to the supply of articles, to prices of articles and to properties or characteristics of articles. In terms of supply, in limited cases, the cost of compliance may result in certain products being taken off the market, resulting in less supply (which could conceivably impact both positively and negatively on consumer costs depending on the application and alternative market offerings); or in a change of characteristics of products available for consumers. For instance, the reparability aspect may create a short termed impact of increased supply of goods with shorter service lives and a decreased supply of long-life goods. Though consumers will usually pay less for a short-life product, the cost per year of operation will usually be similar or more expensive in comparison with long-life articles. Regarding secondary market aspects, the range of products supplied by renting and leasing firms may also change in this regard and result in higher costs for some activities as well as limited supply of certain articles. These impacts are expected towards the 2019 deadline and would slowly alleviate as compliance is achieved and the effect of repair and secondary market aspects decreases. As impacts are short termed, the overall magnitude is assumed small. A last issue in this regard concerns the ability to enact warranties of products. On the one side, as repair of malfunctions may be limited, manufacturers may apply limitations to warranty scope or duration in new products⁵⁹. On the other hand, reparability issues that can-

⁵⁹ In this regard it should be noted that Article 5(a) of Directive 1999/44/EC of the European Parliament and of the Council of 25 May 1999 on certain aspects of the sale of consumer goods and associated guarantees, stipulates that sellers can be held liable, where the conformity of a product to the contract of sale (understood to be applicable to e.g. qualities of the product) is not retained over a period of two years of purchase. This means that product warranties are not expected to be shortened below this period; however the scope of qualities that are guaranteed to this end may change, as long as this is clear at the time of sale.

not be solved with non-compliant parts shall result in manufacturers providing consumers with new products that may be comparable to original products in terms of quality but could remain in service longer (new product). As this implies both costs and benefits, it is assumed that the overall costs will be negligible or small.

3.5.1.3 Social Impacts

Impacts on employment – A number of impacts could be relevant which would contribute to the overall employment situation. It should be noted that the RoHS requirements do not differentiate between EU and non-EU manufacture, and for this reason it is not envisioned that industry would shift between countries to avoid compliance, leading also to a shift in job opportunities. Where this may differ is in the manufacture of components or applications for which compliant manufacture is already operative in some countries, in contrast with non-compliant manufacture relevant to others. The same is true in the manufacture of innovative applications, as in some industries manufacture of niche technologies is concentrated in a few countries, whereas manufacture of standard technologies would be concentrated in others. As it is hard to say to what degree such shifts would be relevant for EEE newly in scope, it is difficult to assume if such shifts would balance one another or result in a strengthening of industry in some countries and a weakening in others. It is therefore assumed that such impacts would not create a significant impact.

The effort of compliance may create more opportunities in terms of research into substitutes though such impacts would be low in light of assumed availability of existing substitutes where similarities to compliant products are apparent. Additionally, positive impacts are expected where redesign of products is needed, assumed to be more relevant to enable implementing of new and old substitutes into design and manufacture. This would result in a moderate effect. In some cases redesign of manufacturing processes and lines may create more job opportunities where supply of machinery is concerned. Negative impacts expected where reparability is impacted would result in less work for repair operations. All benefits (or costs) are expected to be short lived and assumed to incur mainly before compliance deadlines. A negative impact on employment may be relevant if the burden of compliance results in a loss of product portfolio diversity in some companies. This could be a long term loss, though it would be expected to be replaced with time with new designs, or balanced by increased employment in companies producing compliant alternatives. However, this is not expected to have a significant role as demand for products is not expected to change.

Impacts on consumer behaviour – Such impacts would mainly be expected where the Directive has a negative impact on the supply of products or the properties of products both in terms of quality of performance and product lifetime. The first case is mentioned in light of possible effects on the market life of products, which may mainly impact the supply of second hand and refurbished goods as well as supply of goods which may be rented or leased. Areas where such supply is to decrease or to become more expensive would result in a shift toward direct acquisitions (first time buys) and vice versa. As for impacts in light of quality properties the main concern is product lifetime, which may be shortened where reparability does not apply (mainly relevant for long-life products). This would result in a shift towards compliant products and possibly towards short-life products which are often less expensive, and would be consid-

ered to have better relation between price and service time. Though this could have an impact on private consumers, it is mainly expected to impact commercial ones, as well as repair shops and leasing operations, where more awareness may exist to RoHS compliance and to the consequences in terms of product life and reparability.

Impacts on health – As such impacts are mainly associated with differences in the amount of RoHS substances to be used in products, an improvement of such impacts would be expected; slowing down once compliant deadlines pass and exemptions become obsolete. This will also be affected by reparability, in light of use of substances in manufacture of non-compliant parts. However, the continued use of products would have a beneficial effect in light of reduced need to treat waste and general reduction in resources for production of new devices to replace those that could not be repaired. It could be argued that impacts to the supply of medical equipment could result in negative impacts to patient health; however the medical sector has requested numerous exemptions in the last years and is assumed to be quite progressed with compliance in light of coming into scope in 2014 and 2016. The decrease in the number of requests made supports this assumption.⁶⁰

3.5.2 Analysis of impacts for policy options

On the basis of the information presented above, various impact indicators were identified and compared for the various policy options. The main impacts relevant for Options 2-5 are summarized in the following subsections.

3.5.2.1 Option 2: The Cat. 8 & 9 scenario

This policy option shall only have an influence on impacts relevant in the Baseline Scenario for Cat. 8 and 9 non-compliant articles placed on the market between 02 January 2013 and the respective compliance deadlines (22 July 2014/2016/2017). In light of the exclusion of such articles from the secondary market limitations of Article 2(2), such articles shall be allowed further circulation on the market throughout their complete service life. This could have a positive environmental benefit in light of articles not reaching end-of-life early, or could change the distribution of environmental impacts, should the limitation result in the earlier export of such articles to non-EU countries to enable further use. In this regard, public authorities may have a positive benefit as market surveillance measures to enforce limited secondary market operations of such articles would not be needed. Consumers are also expected to see a benefit in terms of revocation of circulation limitations and further supply of a wider range of products by secondary market operations (renting, leasing and resale). This would also remove possible shifts of consumers from long-life to short-life products stemming from the change in articles supplied by secondary market operations. This policy option is not expected to have an influence on impacts concerning EEE newly coming into scope beyond articles of Cat. 8 & 9.

⁶⁰ See requests in evaluations that have been performed after approval of RoHS 2 legal text in 2011: <http://rohs.exemptions.oeko.info/index.php?id=73>

3.5.2.2 Option 3: The 2019 scenario

This policy scenario will impact all non-compliant articles placed on the market before the various compliance deadlines, where secondary market operations are concerned. In terms of environmental impacts, a positive benefit is expected in light of the removal of secondary market limitations. Such articles will be allowed further circulation on the EU market, eliminating possible negative impacts tied to early end-of-life of products removed from the market, as well as possible changes in the distribution of environmental impacts resulting from export of such items. Market surveillance measures to enforce the removal of such articles from the EU market shall also no longer be needed, resulting in lower costs for public authorities. The allowed secondary market operations shall remove impacts on consumers tied with the limited supply of non-compliant articles by secondary market operations, with most of the benefit being attributed to the supply of secondary long-life products. As EEE newly in scope can still not be repaired with non-compliant spare parts, impacts tied to reparability of non-compliant articles shall remain unchanged.

3.5.2.3 Option 4: The 2017 scenario

This scenario is similar to the 2019 Scenario in terms of impacts, with the only difference being that the compliance date for EEE newly in scope is to be brought forward. A positive impact is expected regarding all environmental aspects as compliance shall be accomplished earlier at least for some articles. Where the secondary market limitations affect environmental indicators, these shall apply to a smaller group of articles (non-compliant articles cannot be placed on the market after mid-2017), further impacting the magnitude of environmental benefits. As compliance is required earlier, industry is expected to have costs concerning all related economic indicators. Consumers shall have benefits in terms of supply of a wider range of products by secondary market operations as well as benefits concerning the earlier supply of compliant articles. Earlier product compliance means that the number of products that cannot be repaired is expected to be lower, also having a positive impact on consumers. Benefits are expected regarding all social aspects. Though it could be argued that supply shortages could occur where substitution of RoHS substances is not possible before the relevant compliance deadline, it is assumed that most such cases would be solved by obtaining exemptions. Where such non-compliance affects particular manufacturers, complying manufacturers are assumed to take advantage of the situation and increase manufacture accordingly. This would result in a different distribution of costs and benefits, but is not assumed to have a significant impact, as it would be expected to apply to a small portion of cases.

3.5.2.4 Option 5: The spare-part scenario

This is the only scenario which shall resolve the reparability aspects of all non-compliant articles placed on the market before the compliance deadlines. In contrast, it does not impact any other aspects as the deadlines for compliance are not affected and secondary market operations shall also not be affected. To this end, it is to be considered as an option to be coupled with other policy options, should it result in a net benefit. As non-compliant spare parts shall be allowed for use for the repair of articles placed on the market before the compliance deadlines, this scenario shall result in the manufacture of more non-compliant spare parts. This shall have a negative

impact in terms of the use of a larger amount of RoHS substances as well as other resources for the manufacture of parts. However, a positive environmental impact in terms of articles being repaired and thus not reaching end-of-life early is also expected. Where repair aspects are of relevance, industry is expected to be impacted positively: costs shall not be needed for developing compliant spare parts that can be used for repair of non-compliant articles whereas the allowed repair of articles shall have a positive impact on the activity of enterprises connected to such operations (manufacture of parts, further repair of old articles; etc.). Consumers shall also have benefits tied to reparability of long-life articles, also expected to have a positive impact on consumer behaviour in light of possible shifts away from purchase of long-life articles in the Baseline Scenario. Further social aspects regard a positive impact on employment associated with repair operations as well as a possibly negative impact on health in light of additional use of RoHS substances.

Table 3-3 below summarises the estimation of impacts and the comparison of the various options. All indicators in the Baseline Scenario are marked as “no effect”, to provide the reference for a qualitative estimation of impacts for other options. The expected magnitude and direction (cost/benefit) are summarised based on the signs presented in the legend in Table 3-2:

Table 3-2: Legend for impact characterization

Sign	Significance
+++	Substantial positive (beneficial) effect
++	Positive effect
+	Slight positive effect
=	No effect
-	Slight negative effect
--	Negative effect
---	Substantial negative effect
?	Unknown effect

Some elaboration shall also be provided to clarify the main aspects contributing to possible costs and benefits. The impacts of the policy options are thus compared in Table 3-3 below, which only includes remarks for the summary of each area of impact. The full comparison is presented in Appendix A.4.0, where detail is provided concerning the aspects expected to influence the impact, resulting in the estimated magnitude of the impact as specified.

Table 3-3: Evaluation of policy options

	Option 1	Option 2	Option 3	Option 4	Option 5*
Scenario	Baseline	Cat. 8 & 9	2019	2017	Spare-Part
Environmental Impacts					
Reduction in use of RoHS substances (impacts tied to use of hazardous resources)	=	=	=	+	between - and - -
Reduction in use of RoHS substances (impacts tied to emissions, main focus on the end-of-life phase)	=	=	=	+	between - and - - (may vary - strongly depending on substance, application as well as on efficiency of substance waste management)
Environmental impacts tied to EEE reaching end of use life early (reparability limitation)	=	=	=	+	+++
Environmental impacts tied to EEE reaching end of market life early secondary market operation limitation)	=	+	++	++	?
Summary	=	+	++	between + and ++	between - - and +++
		Small benefit in terms of Cat. 8 and 9 secondary market applicability (reparability is already granted)	Moderate benefit in light of solution for secondary market issues.	Small benefit regarding all aspects; Moderate benefit in light of solution for secondary market issues.	Regarding use of RoHS substances, low to moderate negative impact expected; Significant benefit however in terms of elimination of early end-of-life which is expected to result in the use of less resources for new products to replace non-functional ones.

	Option 1	Option 2	Option 3	Option 4	Option 5*
Scenario	Baseline	Cat. 8 & 9	2019	2017	Spare-Part
Economic Impacts					
Costs of compliance with substance restrictions (substitution) - impacts to manufacture / R&D	=	=	=	-	+
Possible distortions of internal market	=	=	=	-	?
Costs of compliance with substance restrictions - impacts to administrative costs of industry (training / process of exemptions)	=	=	=	-	+
Administration costs for public authorities	=	between = and +	+	between = and -	+
Possible changes to market structure (including wider impact on trade with non-EU countries)	=	=	=	-	?
Impacts on consumer supply - in light of compliance with substance restriction	=	=	=	+	?
Impacts on consumer product supply - in light of limited secondary market operations (limited supply of common leasing and renting products or supply of products with low quality)	=	+	++	++	?
Impacts on consumer product value - in light of limited reparability	=	=	=	+	++
Impacts on consumers: in light of warranty applicability of product	=	=	=	+	++
Summary	=	between = and +	+ or ++	- (industry and authorities) ++ (consumers)	between + and ++

	Option 1	Option 2	Option 3	Option 4	Option 5*
Scenario	Baseline	Cat. 8 & 9	2019	2017	Spare-Part
		In light of lower costs for market surveillance by public authorities and benefits for consumers in terms of supply of products in secondary market operations.	In light of lower costs for market surveillance by public authorities and moderate benefits for consumers in terms of supply of products in secondary market operations.	Higher costs for industry regarding all aspects; Slight higher costs for public authorities; and moderate benefits for consumers in terms of supply of products in secondary market operations as well as smaller negative impacts tied to product value and supply.	Small benefits for industry and authorities; moderate benefits for consumers - relevant for all indicators.
Social Impacts					
Impacts on employment	=	=	=	+	++
Impacts on consumers behaviour	=	between = and +	between + and ++	between + and ++	++
Impacts on health	=	=	=	+	-
Summary	=	between = and +	between + and ++	between + and ++	++
		Low positive impacts in light of impacts on consumer behaviour.	Positive impact tied to market use of all products.	Positive impact tied to market use of all products as well as possible positive impacts on the job market.	Positive impact on employment in repair enterprises.
Note: <i>*Option 5 impacts only relevant in the comparison of reparability aspects, which are not available to non-compliant EEE newly in scope in other options.</i>					

Conclusions from the comparison of all options are as follows:

In terms of **Environmental Impacts** all options are understood to have higher benefits than the baseline, with the *2017 Scenario* (Option 4) having the highest score in light of benefits for all indicators (small to moderate). The *Spare-Part Scenario* (Option 5) shall have both environmental costs and benefits assumed, where it is not yet clear how these would balance each other out. To this end, it must be said, that as the reparability aspect remains unresolved in all other options, a positive net benefit would mean that all other options would score higher if paired with this option and vice versa.

In terms of **Economic Impacts**, all options are understood to have equal impacts to the baseline for industry, aside from the *2017 Scenario* which is assumed to have a small negative impact (i.e., a net cost) in this regard. As for public authorities, the *2017 Scenario* shall also result in slightly higher costs, with the *2019 Scenario* (Option 3) having small benefits, followed by the *Cat. 8 & 9 Scenario* (Option 2) which is also expected to have benefits of a lower range (possibly negligible). As for consumers, in terms of “*consumer product supply - in light of limited secondary market operations*” all proposed policy options have benefits in comparison with the baseline, with both the *2017 Scenario* and the *2019 Scenario* expected to have moderate benefits. In parallel, for all other indicators only *Scenario 2017* is expected to have small benefits. The *Spare-Part Scenario* is expected to have moderate benefits for indicators related to reparability, whereas other indicators are irrelevant. Thus all other options would score higher if paired with this option (Option 5).

In terms of **Social Impacts**, overall all policy options show greater benefits than the baseline, with the *2017 Scenario* scoring only slightly higher than the *2019 Scenario*. The *Spare-Part Scenario* shall have small costs (health) with moderate benefits for both consumer’s behaviour and employment, and is thus understood to benefit any other option with which it could be paired. What becomes clear from this initial analysis is that the *Spare-Part Scenario* is expected to have higher benefits in areas where reparability is an issue in the baseline, and thus would contribute to the net benefit of any policy with which it would be coupled. As for the policy options tied with alterations of Article 2(2) and 4(3), the *2017 Scenario* has higher benefits concerning the environment and society, however in terms of economic benefits, only consumers are expected to have benefits in this option which would be equally high in comparison with *2019 Scenario*. As costs for industry and for public authorities would be equal for all policy options aside from the higher costs associated with the *2017 Scenario*, from an economical perspective the *2019 Scenario* would be preferable. As benefits to society are only somewhat higher for the *2017 Scenario* in comparison with the *2019 Scenario*, the net score of these alternatives is probably quite close and would require more detailed review for concluding as to the ranking.

3.5.3 Analysis of Impacts for product examples

To provide some more insight as to how impacts may change for products with differing properties, a number of products for evaluation were identified based on the information provided by stakeholders as well as additional publicly available information. The category definitions and selection of product examples are specified in Table 3-1 above, with each one discussed in the subsections below.

3.5.3.1 Articles with Integrated Lighting Newly Falling in the Scope of RoHS

Lighting Europe⁶¹ (LEU) submitted a contribution to the Stakeholder Consultation⁶² as well as a response to clarification questions⁶³ prepared following the initial contribution. Both documents concern products with an integrated lighting function, which did not fall under the scope of RoHS 1, as the electric function (i.e. lighting) was not the primary function of the product. Subsequent to the new interpretation of dependency on electricity, these products are to be regulated according to RoHS 2.

LEU state that *“A typical case is furniture, which is normally a non-EEE product. Typically, the same type of furniture can be sold with and without a LED luminaire. In case it is sold with an integrated LED luminaire the whole furniture has to be RoHS compliant, including those parts which are normally not EEE, and were probably never assessed against RoHS requirements. Normally, these products are not assessed if sold without LED luminaire. Conformity assessment for the whole product, including all nonelectrical parts, has to be performed according to harmonized European Standard EN50581.”* LEU warns that this group includes *“a huge variety of products for which a reliable impact assessment on cost and benefits is not available and even difficult to prepare”*. Examples of such products equipped with LED lighting specified in the first contribution include: post boxes; art/souvenirs; shoes; signs; music instruments; toys (e.g. scooter with LED in wheel); doors, windows; and mirrors.⁶⁴

Additional examples were provided in LEUs response to clarification questions: clothing; sport equipment; dog collars; cups; porcelain; and carpets. In this regard LEU explained that *“Members of LightingEurope observed that LED has features (e.g. lightweight, small size, little electricity consumption), which inspires other business (entrepreneurs, designers etc.) to use LED in fields where lighting was not present before. As a consequence we can observe an increasing trend to integrate a non-electrical product with LED”*.⁶⁵

Areas of possible non-compliance are tied to the non-electric components of the product. LEU provides some examples of materials where compliance may be a problem, such as in the use of:

⁶¹ LightingEurope is an industry association of 33 European lighting manufacturers, national associations, and companies producing materials. LightingEurope members represent over 1,000 European companies, a majority of which are SMEs; a total workforce of over 100,000 people in Europe; and an annual turnover estimated to exceed 20 billion Euros. LightingEurope is dedicated to promoting efficient lighting practices for the benefit of the global environment, human comfort, and the health and safety of consumers.

⁶² LightingEurope (LEU) (2014a), Contribution to RoHS Stakeholder Consultation Concerning RoHS Scope Review, submitted 10.03.2014, available under: http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/20140310_LE_PP_EEE_Newly_in_the_scope_20140310_final.pdf

⁶³ LightingEurope (LEU), (2014b), Response to Clarification Questions concerning LEU Contribution to RoHS Stakeholder Consultation Concerning RoHS Scope Review, submitted 11.04.2014 per e-mail

⁶⁴ Op. cit. LEU (2014a)

⁶⁵ Op. cit. LEU (2014b)

- “lead in glass (limit 0,2% in EEE)
- lead in brass (limit 4% for brass in EEE, up to 6%, no limit, in non-EEE brass products
- lead in aluminium,
- flame retardants / plasticisers in clothing
- lead in leather
- lead in steel”⁶⁶

LUE explain that as consequence to the inclusion of such products in the scope of RoHS, the administrative burden on clients of the lighting industry, particularly of producers of non EEE products, shall increase. The lack of awareness of such manufacturers to the RoHS compliance requirements may increase the risk for non-compliance of the whole product in such cases. This is stated not to be in line with the WEEE Directive, under which such products are not considered to be WEEE at the end of life and could bring about hundreds of exemption requests.⁶⁷

LUE estimate the main impacts tied with this product group as follows: “The logical reaction of the producers of “EEE newly in the scope” is to avoid costs and risks by not including lighting in their products. Therefore, LightingEurope believes that the open scope has negative impact:

- On the lighting industry in the form of loss of business;
- On producers of category 11 products in the form of increased cost and loss of product diversification; and
- On consumers in the form of decrease of product functionality;
- All while the positive environmental impact is not known and based largely on estimations⁶⁸;

LEU further explains that some guidance is further provided in this regard in the EU COM FAQ document which gives the example of a wardrobe with lighting and “suggests that the whole cupboard is EEE, if lighting and cupboard are integrated and cannot be separated into two fully functional units. In the opinion of LightingEurope this explanation does not remove the legal uncertainty with regard to the question, what is EEE and what is the notion of integration. While the FAQ provides much appreciated guidance, it is not a binding, legal document, and introduces further uncertainty by the addition of the word “integral” and “fully functional unit”. The main concern is understood to be, that despite the compliance of the electric components used in these products, non-compliance of other components shall make the whole

⁶⁶ Op. cit. LEU (2014b)

⁶⁷ Op. cit. LEU (2014a)

⁶⁸ Footnote cited from LEU (2014a): See BIOIS report, for European Commission, DG ENV: Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive, 2012, Annex V, Furniture with secondary electrical functions

product non-compliant (lighting as well as lighting fixtures were in scope of RoHS 1 and are thus expected to be compliant). To avoid this complication, manufacturers of such products are expected to avoid use of electric components, leading to the above mentioned impacts.⁶⁹

LEU thus request a further exclusion be added to Article 2(4) to resolve this issue, and propose the following formulation in this regard: “(k) *non-electrical parts of EEE in Category 11 of Annex I, which are using lighting as a non-primary function*”. As further exclusions from the scope of RoHS are beyond the scope of the current project, this request is not discussed, and the following evaluation shall merely try to shed light on the type and magnitude of impacts tied to this product group.

LEU could not provide data to clarify the scope or the turnover related to the manufacture and sales of such products in the EU, but referred to the estimation made by BIOIS: “*The same report in chapter 1.3.33 tries to estimate the market size of furniture with secondary electrical function, which is around 1% of the total turnover, corresponding to 1.26 billion EUR per year*”⁷⁰. However, to provide some insight to the possible implications of these products being in scope, they provided an estimate as to the fraction of the lighting industry’s turnover, which is tied to the use of lighting in these products: “*At the moment the estimation of LightingEurope is that approximately 5% of the turnover is coming from integration of LED lighting into non-EEE products. This turnover was achieved during the times, when only the lighting part of such integrated products had to comply with RoHS Directive. Since LED technology is very young there is still space for market development. We are not able to estimate however how big this market will grow.*” Later on in the document a further rough estimation was provided of 5-15% concerning the possible loss of business at best-case and worst-case. “*Coming to the implications on the market trends, LightingEurope can at the moment only apply the common business sense to this case. Our conclusion is that the market growth in this segment will lag behind of its potential, what would be without the RoHS compliance obligation to non-EEE part. At the end of the day it is a lost business for lighting industry and lost opportunity for the European economy and European consumers without any significant improvement in the state of environment.*” Examples were also provided for products which can be designed to be custom-made (such as furniture), in which case the burden of compliance is higher as each article will separate compliance documentation.⁷¹

In light of the relevance of the lighting sector to this product group, information was extracted from Eurostat⁷² as to the value of sales of lighting applications in the EU 27. Data is based on NACE classifications for lighting applications such as lamps and lighting fixtures. The total value of the sector in 2012 was estimated to be around €20 billion with fluctuations in turnover of up to 10% in the last few years. Based on

⁶⁹ Op. cit. LEU (2014a)

⁷⁰ Cited in Op. cit. LEU (2014b) as Bio Intelligence Service, Impact Assessment, Annex: Furniture with secondary electrical functions, chapter 1.3.2.5 p. 243

⁷¹ Op. cit. LEU (2014b)

⁷² Op. Cit. EUROSTAT (2014)

the estimations provided by LEU, it is thus estimated that between € 1–1.5 billion of the lighting sector turnover may be at risk where impacts are to arise from the need of products with integrated lighting to be RoHS compliant. The worst case situation would be a loss of business of this volume, though the consultants assume that even if the worst case situation is to be relevant, it would not result in a loss of all business tied to this product group. Detailed statistical information is provided in Appendix A.5.0.

The consultants interpret the information provided by LEU to clarify that two sub-groups can be outlined concerning compliance:

- The first includes products which are free of RoHS substances. The burden of compliance will result in additional costs for the manufacture of articles with integrated lighting, whereas no environmental benefit is expected as the product was RoHS substance free to begin with.
- The second includes products, which may use RoHS substances in the non-electric components (components tied with the lighting function are assumed to be compliant in light of already being in scope of RoHS 1). The manufacturer, who may produce products both with and without integrated lighting, will need to consider if only RoHS regulated products are to be redesigned to be compliant or all products. The latter would be a result of the separation of production lines to be non-feasible. Environmental benefits are expected, with their volume depending on the decision to redesign only RoHS regulated products or all products.

In both cases, the burden of compliance on manufacturers of products normally not regulated under RoHS may result in a decision to discontinue manufacture of products with integral lighting in order to avoid such expenses. It could be argued that the lighting could be redesigned so that it would not be “integral”, however the distinction between “integral” and “non-integral” may not be completely clear to manufactures, as explained by LEU, and is not legally binding as it is provided in the EU COM FAQ document and not in the RoHS legal text. A further result could be that consumers purchase items and lighting fixtures separately and have lighting retrofitted into the item (individually or assisted by a professional craftsman).

A summary of the expected impacts relevant for Option 1 (Business as Usual) is provided in Table 3-4 below.

Table 3-4: Impact expected in Option 1 for products with integrated lighting

Impact area	Impact expected in Policy Option 1: Business as usual
Environmental impacts	Some benefits for products with non-EE components using RoHS substances. If as a result of current legislation, manufacturers shall discontinue manufacture of articles with integrated lighting or shall revert to designs where lighting component is no longer integrated and can be easily removed; this would have benefits concerning the management of waste at end of life. In contrast, where manufacture is not expected to change, more costs shall be relevant in terms of the recycling sector coming to terms with a product which is not WEEE, but must still be included in part in the treatment of WEEE.

Impact area	Impact expected in Policy Option 1: Business as usual
Economic impacts – manufacturers	Additional costs for manufacturers of products with integrated lighting, (technical costs of compliance and administrative costs of compliance). Loss of income where manufacture discontinued, though in most cases consumers are expected to purchase articles without light capability, supplementing a light fixture adjacent to the item or through a retro-fitting of the lighting fixture within the purchased item.
Economic impacts – suppliers	Small to large burden for providing documentation (lighting suppliers and other suppliers respectively). Loss of business where manufacture is discontinued, though in some cases lighting fixtures may be purchased separately and assembled by owner.
Economic impacts – public authorities	Additional costs due to additional products being regulated under RoHS.
Economic impacts – consumers	Loss of product diversity (lighting capabilities) of relevant product groups, though in some cases articles and lighting fixtures would be purchased separately and assembled by owner.
Social impacts – employment	Impacts to incur both in products where production is to be discontinued (negative) and where product compliance is to be sought (positive).
Social impacts – consumer behaviour	Where products are to be discontinued, in some cases consumers may purchase lighting equipment to provide lighting capabilities otherwise supplied by product.
Social impacts – health	Impacts proportional to change in environmental benefit (tied to decrease in RoHS substances)

The implication of the reparability and secondary market aspects were not discussed by LEU regarding this product group, though they may have impacts, as at least some of the products are assumed to be long life and thus also resalable and repairable. Nonetheless, for the most part, the impacts addressed by LEU are not expected to change in light of these two aspects. It is generally expected that the various stakeholders would benefit if the secondary market and reparability issues could be resolved (Options 3 or 4 and 5, respectively), however other impacts mentioned in the table above would not be expected to be significantly affected in the various policy options. In this sense the consultants conclude that this product group is more or less indifferent to the proposed scenarios. For the most part, impacts addressed in this section shall remain similar in all scenarios. In the consultants view some of the uncertainty in this regard could be addressed through clarification of the notion of integrity for products where the electric function is not primary, though, this may also lead to further confusion if not handled carefully.

3.5.3.2 Equipment with an Internal Combustion Engine Newly Falling in the Scope of RoHS

The European Association of Internal Combustion Engine Manufacturers (EUROMOT) submitted a contribution to the Stakeholder Consultation.⁷³ EUROMOT explain that, as the primary energy is not based on electricity but fuel such as petrol, diesel or gas, all equipment powered by internal combustion engines did not fall under the scope of RoHS 1, but would newly be in the scope of RoHS 2, probably falling under category 11. It is further explained that most engine-powered equipment is covered by exclusions under Article 2(4)⁷⁴ and that engine powered equipment above 1000 V for alternating current and 1500 V for direct current is not in scope of the RoHS Directive. Engines are explained to power many different product groups and markets, making the retrieval of market data on this diverse group of products challenging. EUROMOT explain that service life “varies significantly between equipment based on internal combustion engines. Some products may have an average service life of 50h (two years) others in excess of 80,000 hours may still be in service after 25 years. In general, it is common practice to repair equipment based on internal combustion engines and it is an important part of the business. Depending on the type of equipment the engines may have multiple overhauls in their service life. Each overhaul will need many spare parts some of which may contain substances which are restricted under the RoHS 2 Directive”. Detail as to possible parts where RoHS substances shall be required are specified below.⁷⁵

Concerning secondary market operations, EUROMOT explain that “secondary market operations are common for many products based on internal combustion engines. This includes leasing, renting, and secondary sales operated both by retailers and equipment owners. For some products, the secondary market is so well established that the potential for resale is an important factor in the value of the product.”⁷⁶

Concerning the compliance of such equipment, at present the main substances of concern are understood to be lead (Pb) and hexavalent chromium (Cr VI). Cr VI is used for corrosion protection of certain engine parts in current equipment and will probably be needed in the future for spare parts of engines. Manufacturers are working on replacing Cr VI, however, in many cases spare parts will probably not be redesigned. EUROMOT provides the following examples for Pb, which is used in light of the high

⁷³ The European Association of Internal Combustion Engine Manufacturers – EUROMOT (2014), Contribution to RoHS Stakeholder Consultation Concerning RoHS Scope Review, submitted 07.03.2014, available under:

http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140307_EUROMOT_RoHS_2_Oeko-Institut_Review_EEE_newly_in_Scope-Questionnaire_Final_Response_2014-03-07.pdf

⁷⁴ This is understood to refer to the exclusions available in RoHS 2 for large scaled installations stipulated in Articles 2(4)(d and e).

⁷⁵ Op. cit. EUROMOT (2014)

⁷⁶ Op. cit. EUROMOT (2014)

temperature range and the vibration of the engine and the resulting high strength requirement for the solder joints.⁷⁷

➤ Compression Ignition Engines:

- Pb in solder of the Monitoring Instruments is likely to be above the restricted 0.1wt% threshold at homogeneous level;
- Pb in solder in engine control electronic systems exceeds the 0.1 wt% threshold at homogeneous level;
- Likewise Pb in the engine bearing and bushing components of the Combustion Engine is also likely to exceed the 0.1wt% threshold.

➤ Spark-ignition engines:

- Pb in solder for the spark-ignition system and engine control electronic systems exceed the 0.1 wt% threshold;
- Pb in metal alloys for engine body;
- Pb as impurity in recycled plastics.

➤ Pb is also used in the starter batteries of internal combustion engines, which are notably exempted under the End of Life Vehicles Directive covering engines in automobiles.

EUROMOT explains that for some components, particularly in large scale products, present alternatives may result in an unacceptable reduction in service life. Although EUROMOT members have stated their intention to comply by the end of the transitional period, EUROMOT claims that present indications show that some products may not be capable of complying.⁷⁸

Generating sets (GENSETS) and power systems equipment is specified as a sub-group, for which additional information was submitted. Here too repair and secondary market operations are explained to be of relevance, though a large portion of equipment is assumed to be excluded through the Article 2(4) provisions. However in some cases the rental use of equipment does not allow benefiting from these provisions. *“EUROMOT wishes to point out the apparent contradiction caused by the interpretation of the term “Large Scale” in relation to certain applications. In the FAQ document, 12 December 2012, page 11, it is noted that: ‘Machinery that has partial mobility, for example semi-mobile machinery running on rails, can be of ‘permanent use’. On the other hand, EEE that is intended to be used on different sites during its life is not considered as permanent. It is an indicator of permanent use if the equipment is not readily re-locatable (or ‘mobile intended’) and if it is intended for use at one single location.”* In this regard, an example is provided of a 2.5 MW enclosed generating set installed permanently at a pre-defined and dedicated location, which would be excluded as a Large Scale Fixed Installation. In comparison, the same GEN-

⁷⁷ Op. cit. EUROMOT (2014)

⁷⁸ Op. cit. EUROMOT (2014)

SET offered for rental use would not be entitled to this exclusion in light of use in multiple locations. EUROMOT claims that there is a *“significant risk that rental and similar products placed on the market during the transition period may not be capable of being repaired with compliant parts and may be forced out of service, to the detriment of the environment and all stakeholders.”*⁷⁹

EUROMOT also make a short statement concerning professional lawn, garden and forest equipment falling under this product group, which shall be further explained in Section 3.5.3.3 below.

EUROMOT recommend implementing Option 3 (the *2019 Scenario*) as it brings a single date enabling alignment of all EEE compliance with reduced impact to the environment. Option 4 (the *2017 Scenario*) in comparison would artificially shorten the time needed to ensure compliant parts, whereas in some cases significant R&D work is required to establish compliance, stretching beyond the specified timeframe. Concerning Option 5 (the *Spare-Part Scenario*) EUROMOT state that this option will help to clarify and support the needs of products with a long life cycle as well as secondary markets that are an integral part their members business'. If secondary market operation and spare parts provisions are not included, this is said to result in more waste and a negative impact on the environment because of limitations to resale and limitations to service in light of non-reparability.⁸⁰

To provide some indication as to the volume of sales that may be relevant for this case, information was extracted from Eurostat⁸¹. In the information provided by EUROMOT (which concerns combustion engines being used in a diverse range of equipment) it was stated that clarifying the range of sales of all products would be challenging. To provide some indication, the example of generating sets was thus the focus of data extracted from the Eurostat data, regarding sales in the EU 27 between 2008 and 2012 (as opposed to data concerning manufacture of all combustion engines). Data is based on NACE classifications for GENSETs falling under classification “27.11 *Manufacture of electric motors, generators and transformers*”. The total value of the EU GENSET sector in 2012 was estimated to be around €5.5 billion. After a 27% fall in sales in 2009, assumed to be tied to the economic crisis, the market seems to have stabilized in the last few years. Detailed statistical information is provided in Appendix A.6.0.

In the consultant's opinion, it is important to make a distinction between equipment which is only available for professional use, consumer equipment and equipment designed for professional use but also available to private consumers (through renting and leasing operations or through direct purchase). The GENSET example is a private case of the first equipment group; whereas the case of garden equipment, developed in the next section is more relevant to the last group.

⁷⁹ Op. cit. EUROMOT (2014)

⁸⁰ Op. cit. EUROMOT (2014)

⁸¹ Op. Cit. EUROSTAT (2014)

For the GENSET case, the information provided by EUROMOT suggests that costs of compliance shall mainly be a burden in cases where equipment is circulated on the rental market, as such equipment would not enjoy the large scale exclusions which are understood to cover a large portion of GENSETs. In comparison with privately owned equipment⁸² with a single owner (or even multiple owners), rented equipment is expected to have significant disadvantages embodied in the burden of compliance. This would be expressed in the general costs of compliance in terms of technical costs of researching and applying substitutes and in administrative costs of screening product portfolios for compliance issues and preparing and maintaining documentation. As rented equipment will usually have a longer service life and be repairable, additional costs are expected in light of the limitations relevant for both of these aspects on Option 1 (business as usual). As expressed in the general evaluation of options (Section 3.5.2), costs tied to secondary market operations shall be alleviated in policy options 3 or 4, and costs tied to reparability alleviated in policy option 5. However, the differentiation between mobile and fixed (as well as semi-mobile) equipment means that certain market distortions may arise. First of all, manufacturers providing equipment mainly for the rental market would be heavier burdened with compliance than manufacturers providing equipment to a mixed market, not to mention those mainly selling to private users. This burden would either be shifted to consumers (rental operators and further on to consumers) or would give way to a shift of market structure away from rental operations. In both cases costs could be expected for manufacturers, for the secondary market operators and for consumers of rental equipment. Though policy options resolving secondary market and reparability aspects will alleviate some of these costs, they do not provide a full solution. Nonetheless, as it is understood that manufacturers are already preparing for the transition to compliance, it can be assumed that where substitution is possible, it shall be achieved for a larger range of equipment than that falling in scope. This means that if industry is provided sufficient time to comply with the RoHS substance restrictions, additional benefits (in the form of substitution of products excluded from scope) may be relevant. It is thus concluded that providing such products with the longer transition period (2019) would ease the burden of compliance and may have additional positive impacts in terms of the environment and the respective social impacts (health). Provision of a spare parts provision (Option 5) will have similar beneficial effects.

It may be argued that the burden of compliance on the sector, in light of the forced compliance of articles which are not in scope, does not justify the expected benefits of such compliance. However, such aspects were not quantified in the submitted data, nor would the consultants be in the position of recommending further exclusions from scope of certain articles in light of the scope of this project.

⁸² Equipment owned by a professional user could still be sold on to a second user, however as the location is fixed during the period of ownership, such resale is allowed. Ownership periods are also assumed to be longer, as otherwise purchase would be less economic in comparison with rental. Thus such equipment may have a few locations, but would still be interpreted as semi-mobile and benefit from an exclusion from scope.

A further potential subgroup was identified in the case of **equipment in one particular category of EEE with similarity to other groups**. Certain product groups falling under Cat. 11 have been mentioned by stakeholders with regard to their similarities to other categories, in particular those in Cat. 8 and 9 where there are advantageous compliance stipulations within RoHS. EUCOMED Medical Technology and EDMA Diagnostics for Health⁸³, the industry associations representing the medical devices (MD) and in vitro diagnostic (IVD) medical devices sectors respectively, mentioned such product groups in their contribution. They explained that though their products are intended for human medical purposes, similar products were used for veterinary and forensic uses. Despite such similarities, these product groups were assumed to fall under Category 11 of RoHS2. In this sense, the consultants assume that despite similarities of compliance aspects (availability of substitutes) as well as reparability and secondary market aspects, such articles would be penalized in comparison with Cat. 8 & 9 counterparts (under the current legal text, reparability and secondary market operations of non-compliant articles are limited). Furthermore, even if articles are to be granted the same exemptions, the 7 year duration of exemptions for Cat. 8 & 9 would not apply, meaning that maintaining exemptions would also be more burdensome. Though such product groups would be alleviated from the former mentioned costs under the joint implementation of Option 3 (or 4) and Option 5, the latter costs shall still apply. To conclude, it appears that additional areas may exist where similar articles have requirements which are slightly different. However, further information was not made available by such stakeholders. As it is assumed that the manufacturers of such equipment are for the most part the same manufacturers as those of Cat. 8 & 9 equipment, the consultants assume that the additional burden did not justify providing a contribution to quantify the difference of costs in such cases.

3.5.3.3 Gardening Equipment Newly Falling in the Scope of RoHS

EGMF, the European Garden Machinery Industry Federation submitted a contribution to the Stakeholder Consultation.⁸⁴ The data they provide concerns the possible impacts expected where garden equipment is concerned. They provide a list of equipment which would fall under this product group including augers; blowers/vacuums; brush cutters; chain saws; edge trimmers; grass trimmers; hedge trimmers; high pressure cleaners; ice augers; lawn and garden tractors; lawnmowers; log splitters; motor hoes; pole prunes; pumps/submersible pumps; scarifiers/turf aerators; shredders; snow throwers; sprayers; stump grinders; and sweepers. All of these products are specified to be newly in scope in light of the change in the definition of EEE (inter-

⁸³ Eucomed & EDMA (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 10.03.2014, available under: http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_EDMA_Eucomed_RoHS_Art_2_2_and_Art_4_consultation_response_to_Oeko_Institute_2014_03_10_PUB.pdf

⁸⁴ EGMF (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 28.02.2014, available under: http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_FINAL_EGMF_answers_to_Oko_28022014_all6parts.pdf

pretation of dependency on electricity). For most products, similar items exist which are already in scope in either battery or electric powered versions. However, articles operated with petrol but with an electrical function were not in the scope of RoHS 1, though these are now to be regulated within RoHS 2. This regards a total of 8.6 million units of equipment, estimated for Europe (geographical) sales volumes for 2012 of petrol driven machines, for EGMF members only.⁸⁵

The average service life of products is 10 years and all equipment is said to be repairable. All parts are explained to have spare parts and examples of critical ones, in which RoHS regulated substances, are used, being: e.g. electric parts, fasteners, blades, coated/plated parts. Furthermore all of these products can be leased, rented or can be sold as second hand products.⁸⁶

EGMF⁸⁷ provides information about compliance of equipment as presented in Table 3-5 below:

Table 3-5: Compliance of petrol powered garden equipment with the RoHS substance restrictions

Presence of RoHS regulated substances (% weight & quantity of substance):	
Lead	<i>Yes, in solder, metal alloys, ceramics, recycled plastics. Estimation: 0.74 g in solder per product. Investigations are still ongoing and it is unknown precisely how much lead remains in the product.</i>
Mercury	<i>No</i>
Cadmium	<i>Yes (in switches/recycled plastics)</i>
Hexavalent chromium	<i>Yes, on fasteners and other steel parts for corrosion protection. Estimation: up to 200 µg per product</i>
Polybrominated biphenyls (PBB)	<i>Yes, mainly in plastics, insulation parts, paints, electric parts Investigations are still ongoing and it is unknown precisely if / how much PBB remains in the product.</i>
Polybrominated diphenyl ethers (PBDE)	<i>Yes, mainly in plastics, insulation parts, paints, electric parts Investigations are still ongoing and it is unknown precisely if / how much PBDE remains in the product.</i>

Source: Op. cit. EGMF (2014)

It is understood that in most cases exemptions or alternatives are available, with the main concerns of substitution being focused on lead in general usages, and cadmium in switches. It is explained that the substitution with lead free solder may result in a reduction of the lifespan of the entire product, due to reduction of the lifespan of certain components of the product for which lead free solder has been used. This would result in an increase of the waste generated in light of early end-of-life. Investigations are still ongoing regarding the possible effects of lead free solder on the lifespan of

⁸⁵ Op. cit. EGMF (2014)

⁸⁶ Op. cit. EGMF (2014)

⁸⁷ Op. cit. EGMF (2014)

product/components. EGMF provide a roadmap of the stages needed to enable compliance with RoHS, estimating a total of 6 to 8 years needed for compliance of new products (time differs for various products included in the product range). It is further stated that (under the current legislation) exemptions would be needed to enable the use of non-compliant spare parts for repairing equipment already on the market.

A table comparing the costs and benefits of each of the proposed policy options is provided by EGMF to clarify that Option 3 (the *2019 Scenario*) and Option 5 (the *Spare-Part Scenario*) are preferable for this sector. Option 4 (the *2017 Scenario*) would resolve the limited secondary market issues, but would require earlier compliance, possibly increasing costs in light of insufficient time. Option 2 is understood to be irrelevant as it shall not change the impacts relevant for products of EGMF members.

On the basis of the information provided by EGMF, the consultants could estimate that in 2012 the following quantities of RoHS substances were brought on the market:

- Lead – 6.364 kg (an average of 0.74 g per each of 8.6 million units placed on the market in light of use of lead solders, metal alloys, ceramics and recycled plastics);
- Hexavalent chromium – 1.72 kg (an average of 0.0002 g per each of 8.6 million units placed on the market in light of use in fasteners and other steel parts where corrosion protection is relevant).

It is assumed that as compliance is achieved towards 2019, these quantities shall decrease. It is further understood that especially concerning the use of lead, this decrease may require additional time beyond 2019, where exemptions already exist or would be requested. These reductions are observed as an environmental benefit of compliance, with various costs being tied to the efforts needed for such benefits to incur. In light of the time needed specified by EGMF for the various stages of achieving compliance (including research of substitutes {2 years} testing {2 to 3 years} and redesign {2 to 4 years}), it can be followed that achieving compliance before 2019 would be difficult, and would result in additional costs since various stages would need to be performed in parallel (where this can be done). It can also be followed that in some cases, earlier deadlines shall not result in earlier benefits, and it is unclear if the additional benefit of an earlier deadline (2017) would justify earlier environmental benefits. In this regard, it can be followed that Option 3 (the *2019 Scenario*) will be preferable in terms of the cost of compliance for industry and society (considering impacts on manufacturers, impacts on secondary market operations, and impacts on employment). If this Option 3 is coupled with Option 5 (the *Spare-Part Scenario*), then benefits, in terms of reparability shall also incur for industry, for the environment and for society (employment, health).

3.5.3.4 Toys Newly Falling in the Scope of RoHS

The Toy Industries of Europe (TIE) Association submitted documents, prepared in the course of the BIOIS report, to the Stakeholder Consultation. As documents were listed as confidential, TIE was sent clarification questions and requested to provide information that could be made public. The information concerning toys regulated under RoHS is based on the response⁸⁸ provided by TIE to these questions.

To provide some indication as to the volume of sales that may be relevant for this case, information was extracted from Eurostat⁸⁹ as to the value of sales of toys in the EU 27. Data is based on NACE classifications, which in the case of toys are understood not to fall under the group classifications of EEE. The total value of the EU toy sector in 2012 was estimated to be €5.2 billion with large fluctuations in turnover (annual changes of -4% to +31% have occurred over the last 5 years). As separating between data for conventional toys and toys with electric functions is not feasible in terms of the available classifications, it cannot be determined what part of this value would be attributed to EE toys, let alone to EE toys newly in scope. Detailed statistical information is provided in Appendix A.7.0.

Toys falling under the scope of “EEE newly in scope” are understood to be “toys with a minor electrical function” as these would fall under RoHS 2 in light of the new interpretation of dependency on electricity. The compliance of such products is also to be underway if not already achieved: *“All members of TIE, and all its members’ members are aware of the new situation and of the new scope of RoHS, and therefore have already taken measures to make sure they will comply with the new requirements when these will enter into force after the transition period. The biggest toy manufacturers have long taken the approach that any electrical toy (regardless of whether the toy has a primary or secondary electrical function) needs to comply with RoHS.”* Such articles are characterised as follows: *“24 categories of toys were identified that contained electrical or electronic (EE components). The average electronic content of EE toys was found to be 8%. This includes circuit board & wiring (1.7%), motors and transformers (6%).”* It was estimated that nearly 85,000 tonnes of EE toys were sold in the EU in 2002. The applicability of these quantities in 2014 was explained by TIE stated as follows: *“In some Member States such as Spain, the amount (in Kg) of electrical toys decreased by 8% from 2011 to 2012, and by 13% from 2012 to 2013. However, we cannot tell whether this is a result of the economic crisis or responds to other reasons. We will have to check the data and tendency of the coming years.”*⁹⁰

The consultants understand this to mean that some of the larger enterprises already comply, whereas others are expected to become compliant by 2019. A possible exception to this understanding may be in smaller enterprises (SME's) which may not be fully aware of the RoHS Directive and its possible implications.

⁸⁸ Toy Industries of Europe (TIE) (2014), Response to Clarification Questions Sent by Oeko-Institut, submitted per e-mail on 01.04.2014.

⁸⁹ Op. Cit. EUROSTAT (2014)

⁹⁰ Op. cit. TIE (2014)

Concerning Compliance of EE toys, TIE provide the following information: *“...it is important to note that the average metal content of EE toys is low at 7% compared to 51% in most WEEE. Toy manufacturers do not “use” heavy elements. Toys have been regulated for heavy metals for many years and the toy industry complies with these regulations. Legislation such as REACH, RoHS or the Batteries Directive add to the recently revised Toy Safety Directive 2009/48. The new migration limits for 19 heavy elements (incl. lead, cadmium, mercury and chromium VI) laid down in the Toy Safety Directive apply as of July 2013. Very minor quantities (traces) of lead might be found in EEE toys, due to its natural occurrence in raw materials and mainly due to the solder used. Mercury is not likely to be found in toys. Chromium VI compliance has not been an issue for toys that are within scope of RoHS until now. Flame retardants PBB and PBDE are not used in toys. They were banned for a very large group of products, and they have essentially disappeared from the supply chain.”* It is thus understood that RoHS substances should not be contained in toys, unless possibly in alloys used for soldering purposes. Where these are applied in electric components, acquired from suppliers, these areas were explained to be easier for achieving compliance, as suppliers will probably manufacture components for other EEE and so either compliance has been achieved, or the transition is expected to be relatively simple. In comparison, where solders are used by the toy manufacturer, this could be more complicated as in the past *“... a number of relevant companies have replaced their solders by lead-free solders. These companies have had to modify their toys as the solder was different and reacted differently. It was not easy.”*⁹¹

The consultants assume that complications with solders were more relevant for toys with primary electric functions that have already come into scope under RoHS 1, whereas in toys with secondary electric functions, electric components will more often be provided by suppliers, making compliance easier. It is not known to what degree this assumption would clarify the easier compliance, however TIE estimate in this regard that given sufficient time, compliance should not be problematic *“Toy manufacturers of toys with a secondary electrical function (new in scope) will be compliant at the date of entry into force of the new obligations. In fact, manufacturers, who need around 18 months to prepare and design new products, are already taking these new obligations into account. As RoHS-compliant components are already available on the market, no big hurdles are expected.”*

The consultants thus conclude that achieving compliance by 2019 should not be a problem for the toy industry. If the date of compliance was moved to 2017, as long as it could be ensured that industry would be notified at least 18 months ahead of time (mid 2016), compliance would probably still be possible. In this regard however, the consultants assume that this may result in some negative financial impacts to business as it would require a change of business plan to ensure earlier compliance. It is unclear if compliance in this regard is still forthcoming in some cases (subsequently also resulting in associated environmental benefits) or if this mainly requires an administrative effort to guarantee that electric components, obtained from the supply chain, are indeed RoHS compliant.

⁹¹ Op. cit. TIE (2014)

Concerning Secondary Market Operations, TIE state that “Toys are often kept in attics, collected by collectors or simply kept for many years for emotional reasons, and therefore the life expectancy of a toy can be very long. It is almost impossible to have accurate data on secondary market operations, but we can be sure that toys are part of many charity actions in Europe where second-hand products are sold at lower price or offered. In any case, these toys are compliant with the legal requirements applying at the time they were placed on the market for the first time.”⁹²

In the consultants opinion, though it is unclear what part of such products would fall under the definition of EEE newly in scope (in light of date placed on the market), it is understood that in such cases, such charity activities would have to adapt activities to comply with RoHS. This may result in a few scenarios: (1) Charities may choose to offer such EEE free of charge to avoid complications or otherwise (2) it would need to be discarded or (3) exported to non-EU countries. Though the first and latter option may have benefits to society (in the EU or in other countries, respectively), they would result in higher costs/lower benefits for the charities. Discarding of such toys would have negative environmental costs as products would reach end of life early and charities would also have a loss of income in this regard, which facilitates their activities in general. Though it is unclear if implementing RoHS regulation in the context of charity sales is feasible, it can be understood that the current situation would lead to various costs that would be avoided if the secondary market aspect was resolved. Society may have lower benefit in this regard (as toys will not be given free of charge or supplied to countries outside the EU, however these are assumed to be balanced with the elimination of charity costs, which would result in less charity activities for society in light of less financial resources. Thus the environmental benefit would also be in favour of resolving this issue.

The following information was provided which provides some background for aspects of Reparability. The life time of toys is explained to be rather long. “A recent TIE study from 2012 shows that the average life expectancy of a toy can be very long ... life cycle of an electric toy will obviously depend on the toy itself and the use the consumer makes of it. The study found that it is rare for toys to be thrown away. 19 out of every 20 toys are either stored or re-used after use, usually by passing the toy onto friends or family or donating to charity or nursery. Toys are generally kept in the house for a long time prior to being given up for re-use. Typically toys are kept for between 6 to 12 years. The mean time they are kept is 10 years... In general, toys are not subject to repairs, because it is much less cost effective to do this than for other more expensive products”⁹³

The consultants thus understand that despite the long life time of toys, repair may not be a common practice where use continues regardless of dysfunction of electrical components. For example, a teddy bear with a light function is assumed to remain in use as such, regardless of the operation of the light component. Articles where use would be discontinued in the event of electric malfunction, are assumed to already be

⁹² Op. cit. TIE (2014)

⁹³ Op. cit. TIE (2014)

in scope through RoHS1 since the electric components provide the main function in this case (such as in computer game devices). Against this background, this project category would be relatively indifferent to addition of a spare part provision.

To conclude, it is understood that Option 3 (the *2019 Scenario*) would be preferable for the toy sector, as it would solve the possible problems of secondary market operations. Such operations, mainly relevant in light of charity activities, are understood to have an impact on the environment, on society and on consumers and not to be a concern of industry. Though Option 4 (the *2017 Scenario*) is expected to solve secondary market operations as well, it may result in some costs for the toy industry as well as their supply chain, in light of need to reallocate resources to support earlier transition to RoHS compliance. From a comprehensive perspective, **Option 3 would thus be preferable**, as all other factors are understood to remain unchanged. The addition of a spare parts provision (*Option 5*) in Article 4(4) is not expected to have an impact on the toy sector, which would thus be indifferent to its implementation.

3.6 Conclusions

Although the analysis of various product groups demonstrates that different manufacturers may be impacted by certain options a bit differently, it suggests that the best ratio between costs (mainly for industry) and benefits (mainly for the environment) are found where Option 3 (the *2019 Scenario*) is implemented along with Option 5 (the *Spare-Part Scenario*). Examples where this is not the case (articles with integrated lighting) are indifferent to the implementation of the proposed options and thus do not change this balance. Though it may be argued that the 2017 Scenario (Option 4) could reach similar environmental benefits within a shorter period, the various examples have not demonstrated in most cases that earlier deadlines would generate early compliance in terms of environmental benefits. It can also be followed that for some products this would just create additional requests for exemptions or requests to maintain existing ones, meaning additional costs for both industry and public authorities with marginal benefit for the environment in terms of early compliance. The contribution of the Swedish Chemicals Agency (KEMI)⁹⁴ is the only contribution submitted by a public authority, and it also supports these options. KEMI explain that not permitting the use of spare parts for all failing EEE would lead to a waste of resources. KEMI is of the opinion that it is beneficial if failing products can be restored by the use of spare parts.

KEMI further explains that removing time restrictions for secondary market operations of products placed on the market before compliance deadlines is also viewed as beneficial. However, in this regard a time limit for “second hand operations” of equipment that has never been operated by an end user is proposed. The consultants understand this proposal to be concerned with the possible practice of stocking of non-compliant articles by enterprises other than the original manufacturer, shortly before

⁹⁴ The Swedish Chemicals Agency (KEMI) (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 14.03.2014, available under: http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_Keml_comments_to_SC_RoHS_2014_1_Scope_review.pdf

the compliance deadlines. In this case, articles would be considered to have been placed on the market (first time sale) and thus to be allowed secondary market operations, despite never being used. Manufacturers would have an incentive to manufacture non-compliant articles in excess of the actual market demand, creating negative impacts for the environment. The consultants can thus follow that a time limitation may be relevant for articles which have never been used, to avoid such negative impacts.

3.7 Monitoring and Evaluation

If the legal text remains unchanged, the assumption is that monitoring and evaluation are addressed through the current legislation, as they are currently in scope and it is understood that provisions for monitoring and evaluation would have been addressed at the time of deciding on their inclusion in scope.

All further options are understood to alleviate some of the pressure on industry in terms of time and in some cases in terms of compliance (spare parts), and it is thus assumed that additional measures shall not be needed, though the range of implementing such measures may evolve differently -

- In options where Article 2(2) is to be incorporated into Article 4(3) (Options 3 and 4, the 2019 and 2017 Scenarios), measures for monitoring the removal of non-compliant products from market circulation after compliance deadline shall no longer be needed as secondary market operations shall no longer be limited.
- In options where a spare part provision is afforded, measures for monitoring the use of non-compliant spare parts and cables in non-compliant products that have come on the market, before the substance restriction obligation applied, shall also no longer be needed. In parallel, it could be that measures are required to ensure that such non-compliant parts are not used for the repair of compliant products (where this may save costs or allow use of older, stored stocks). This type of measure is in any case required at present for such monitoring of other EEE and so it is assumed that the volume of measures may increase, but that new measures do not need to be developed.

3.8 Recommendations

On the basis of the evaluation of the various aspects, the consultants recommend integrating Article 2(2) into article 4(3), in order to provide the 22 July 2019 as a compliance date for articles newly coming into scope. A limitation for articles which have never been operated should be considered; limiting resale of such articles to 1-2 years, in comparison with equipment circulated and operated at least a year before this date. Article 2(2) would lose its relevance and could be emitted from the legal text, solving possible uncertainties of Cat. 8 and 9.

The following articles are suggested to be reformulated into Article 4:

Article 4(3) should read as follows:

“Paragraph 1 shall apply to medical devices and monitoring and control instruments which are placed on the market from 22 July 2014, to in vitro diagnostic medical de-

VICES which are placed on the market from 22 July 2016, to industrial monitoring and control instruments which are placed on the market from 22 July 2017, and to Annex I category 1-7, 10 and 11 EEE that was outside the scope of Directive 2002/95/EC but in scope of this current Directive and which is placed on the market from 22 July 2019.”

An additional item (g) should be added to Article 4(4) concerning the use of spare parts in EEE newly in scope, reading as follows:

“Paragraph 1 shall not apply to cables or spare parts for the repair, the reuse, the updating of functionalities or upgrading of capacity of the following:

...

(g) EEE of Annex I categories 1-7, 10 and 11, that was outside the scope of Directive 2002/95/EC, but in scope of this current Directive, and which is placed on the market before 22 July 2019;”

In both cases, the consultants recommend the proposed changes be reviewed by the Commissions’ legal department to ensure that the formulations are clear and do not create new uncertainties or possible misinterpretations.

As for the possible limitation for articles which have never been operated, consideration should be given regarding which article in the Directive could address this point and what the correct legal terminology should be in order to avoid misinterpretations and uncertainties. In general, it is recommended to limit the circulation of articles placed on the market, which have never been used, to avoid intentional stocking of non-compliant products, shortly before compliance is required. As retailers must have sufficient time to sell articles purchased shortly before compliance deadlines, in the consultants view a year from the time the article was placed on the market should suffice. The legal language would need to clarify, that articles coming into use by end-consumers in this way, would not be limited in terms of further secondary sales.

3.9 References

Arcadis & RPA (2008)

Arcadis Ecolas & RPA (2008), A Study on RoHS and WEEE Directives - Final Report, 06/11925, prepared for European Commission DG Enterprise and industry, pg. 103, 110

BIOIS (2012)

BIO Intelligence Service – BIOIS (2012), Measures to be implemented and additional impact assessment with regard to scope changes, pursuant to the new RoHS Directive, Final Report prepared in collaboration with ERA Technology for the European Commission, DG ENV, retrieved 20.01.2014 from:
http://rohs.biois.com/documents/RoHS_II_IA_Final_Report.pdf

EGMF (2014)

European Garden Machinery Industry Federation – EGMF (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 28.02.2014, available under:
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_FINAL_EGMF_answers_to_Oko_28022014_all6parts.pdf

- Eucomed & EDMA (2014) Eucomed & EDMA (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 10.03.2014, available under:
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_EDMA_Eucomed_RoHS_Art_2_2_and_Art_4_consultation_response_to_Oeko_Institute_2014_03_10_PUB.pdf
- EUROMOT (2014) The European Association of Internal Combustion Engine Manufacturers – EUROMOT (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 07.03.2014, available under:
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140307_EUROMOT_RoHS_2_Oeko-Institut_Review_EEE_newly_in_Scope-Questionnaire_Final_Response_2014-03-07.pdf
- EUROSTAT (2014) EUROSTAT statistics on the production of manufactured goods for the years 2008-2012, available under
http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel and data on “GDP and main components – Current prices [nama_gdp_c]” for the years 2008-2012
- KEMI (2014) The Swedish Chemicals Agency – KEMI (2014), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 14.03.2014, available under:
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/Products_newly_in_scope/20140310_KemI_comments_to_SC_RoHS_2014_1_Scope_review.pdf
- LEU (2014a) LightingEurope – LEU (2014a), Contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted 10.03.2014, available under:
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_IA_2_2/20140310_LE_PP_EEE_Newly_in_the_scope_20140310_final.pdf
- LEU (2014b) LightingEurope – LEU (2014b), Response to clarification questions to LEU contribution to RoHS stakeholder consultation concerning RoHS scope review, submitted per e-mail on 11.04.2014
- TIE (2014) Toy Industries of Europe (TIE) (2014), Response to clarification questions sent by Oeko-Institut, submitted per e-mail on 01.04.2014.

APPENDICES

A.1.0 Appendix 1: Definition of electric bicycles relevant for this assessment

Directive 2002/24/EC⁹⁵ of the European Parliament and of the Council of 18 March 2002 relating to the type-approval of two or three-wheel motor vehicles and repealing Council Directive 92/61/EEC provides the scope of two wheel vehicles which must be type approved. In contrast, in Chapter 1, Article 1(1) the Directive specifies vehicles to which the Directive does not apply as follows:

- “(a) vehicles with a maximum design speed not exceeding 6 km/h;*
 - (b) vehicles intended for pedestrian control;*
 - (c) vehicles intended for use by the physically handicapped;*
 - (d) vehicles intended for use in competition, on roads or in off-road conditions;*
 - (e) vehicles already in use before the application date of Directive 92/61/EEC;*
 - (f) tractors and machines, used for agricultural or similar purposes;*
 - (g) vehicles designed primarily for off-road leisure use having wheels arranged symmetrically with one wheel at the front of the vehicle and two at the rear;*
 - (h) cycles with pedal assistance which are equipped with an auxiliary electric motor having a maximum continuous rated power of 0,25 kW, of which the output is progressively reduced and finally cut off as the vehicle reaches a speed of 25 km/h, or sooner, if the cyclist stops pedalling,*
- nor to the components or technical units thereof unless they are intended to be fitted to vehicles covered by this Directive.*

It does not apply to the approval of single vehicles except that Member States granting such approvals shall accept any type-approval of components and separate technical units granted under this Directive instead of under the relevant national requirements.”

It is thus concluded that two wheel electric bicycles falling under this list of exclusions are non-type approved electric two wheel vehicles.

- As the RoHS Directive exclusion refers to two wheel electric vehicles, Articles 1(1) (f) and (g) are considered irrelevant as they address vehicles with more than two wheels.
- Furthermore, Article 1(1) (h) is the only article referring to cycles as well as to an electric rated power. It is thus assumed that two wheel vehicles falling under this article would be considered non-type approved electric two wheel vehicles, which at present are required to be RoHS compliant.

⁹⁵See <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02002L0024-20130701&from=EN>

- It cannot be concluded that no two wheel electric vehicles fall under Articles 1(1)(a) through (e). However as it is not specifically mentioned, it shall be assumed for the sake of simplicity that such vehicles either have more or less wheels , thus still covered by the RoHS exclusion. The technical specifications of this project have requested an assessment of a possible exclusion of electric bicycles. Thus it has furthermore been assumed that such vehicles will either not be understood to be a bicycle or will coincide with the specifications of Article 1(1)(g).

Though it is possible that additional vehicles are non-type approved electric two wheel vehicles, it is assumed that none of these would be understood to be a bicycle, and thus none of these would benefit from any possible changes to the status of electric bicycles in the context of the RoHS Directive for which this assessment has been performed. Thus, the assessment shall refer to bicycles with the specifications listed under Article 1(1)(h) of Directive 2002/24/EC also referred to as Pedelecs.

A.2.0 Appendix 2: Data on bicycle sales and production in the EU

Source: COLIBI, 2013, Industry and Market Profile of the EU Bicycle Market in 2012, available under:

<http://www.colibi.com/docs/issuu/European%20Bicycle%20Market%20&%20Industry%20Profile%20-%20Edition%202013.pdf>

The following tables have been copied from COLIBI (2013) in light of their relevance as a basis for data used in the assessment.

EU Bicycle production (EU 27), thousands of units:

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bicycle Production (x 1,000)	14 531	13 009	12 272	12 828	13 232	13 218	13 320	13 086	13 246	12 178	12 241	11 758	11 537
Evolution year/year-1 (%)		-10,47	-5,67	4,53	3,15	-0,11	0,77	-1,76	1,22	-8,06	0,52	-3,95	-1,88

2012 European bicycle production (EU 27) country share (1,000 units)

Country	Germany	Italy	Poland	The Netherlands	France	Bulgaria	Portugal	Romania	Hungary	Spain	Czech Republic	Lithuania	Slovakia	Austria	Greece	Sweden	Belgium	Great Britain	Finland	Slovenia	Cyprus	Denmark	Estonia	Ireland	Latvia	Luxembourg	Malta	EU 27
Bicycle Production (x 1,000)	2 211	2 195	1 076	900	850	837	780	450	391	370	350	340	220	142	130	115	105	40	30	5	0	0	0	0	0	0	0	11 537
Country share %	19.16	19.03	9.33	7.80	7.37	7.25	6.76	3.90	3.39	3.21	3.03	2.95	1.91	1.23	1.13	1.00	0.91	0.35	0.26	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

2012 European bicycle production (EU 27) country ranking (1,000 units)

Country	Germany	Italy	Poland	The Netherlands	France	Bulgaria	Portugal	Romania	Hungary	Spain	Czech Republic	Lithuania	Slovakia	Austria	Greece	Sweden	Belgium	Great Britain	Finland	Slovenia	Cyprus	Denmark	Estonia	Ireland	Latvia	Luxembourg	Malta	EU 27
Bicycle Production (x 1,000)	2 211	2 195	1 076	900	850	837	780	450	391	370	350	340	220	142	130	115	105	40	30	5	0	0	0	0	0	0	0	11 537
Country share %	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21	21	21	21	21	100	

2012 European bicycle parts & accessories production (EU 27) country share (M€)

Country	Italy	Germany	Romania	France	Portugal	The Netherlands	Czech Republic	Poland	Belgium	Finland	Great Britain	Slovakia	Bulgaria	Hungary	Slovenia	Spain	Austria	Cyprus	Denmark	Estonia	Greece	Ireland	Latvia	Lithuania	Luxembourg	Malta	Sweden	EU 27
P & A Production (M€)	496	260	200	180	120	90	80	60	40	34	31	20	10	10	10	5	0	0	0	0	0	0	0	0	0	0	0	1 646
Country Share %	30	16	12	11	7	5	5	4	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	100

Values exclude VAT

2012 European bicycle parts & accessories production (EU 27) country ranking (M€)

Country	Italy	Germany	Romania	France	Portugal	The Netherlands	Czech Republic	Poland	Belgium	Finland	Great Britain	Slovakia	Bulgaria	Hungary	Slovenia	Spain	Austria	Cyprus	Denmark	Estonia	Greece	Ireland	Latvia	Lithuania	Luxembourg	Malta	Sweden	EU 27
P & A Production (M€)	496	260	200	180	120	90	80	60	40	34	31	20	10	10	10	5	0	0	0	0	0	0	0	0	0	0	0	1646
Ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	13	13	16	17	17	17	17	17	17	17	17	17	17	17	21

Values exclude VAT

2000–2012 European bicycle sales (EU 27) (1,000 units)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bicycle Sales (x 1,000)	18 945	17 745	17 840	20 206	20 322	20 912	21 033	21 344	20 206	19 582	20 461	20 039	19 719
Evolution (%)		-6,33	0,54	13,26	0,57	2,90	0,58	1,48	-5,33	-3,09	4,49	-2,06	-1,60

2012 European bicycle sales by country (EU 27) (1,000 units)

Country	Germany	Great Britain	France	Italy	Spain	The Netherlands	Poland	Sweden	Denmark	Belgium	Austria	Romania	Czech Republic	Portugal	Finland	Greece	Slovakia	Slovenia	Hungary	Lithuania	Ireland	Estonia	Bulgaria	Cyprus	Latvia	Malta	Luxembourg	EU 27
Bicycle Sales (x 1,000)	3 966	3 600	2 835	1 606	780	1 035	992	555	550	450	410	380	350	350	330	320	300	250	232	115	95	65	62	35	35	12	10	19 719
Country share (%)	20	18	14	8	4	5	5	3	3	2	2	2	2	2	2	2	2	1	1	1	0	0	0	0	0	0	0	-
Ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	13	15	16	17	18	19	20	21	22	23	24	24	26	27	-

Sales to customers

2012 European bicycle sales (EU 27) – average price/country (€)

Country	The Netherlands	Germany	Austria	Denmark	Belgium	Luxembourg	Sweden	Finland	Great Britain	France	Italy	Spain	Hungary	Poland	Ireland	Czech Republic	Portugal	Greece	Malta	Romania	Slovakia	Slovenia	Cyprus	Estonia	Latvia	Lithuania	Bulgaria	EU 27
Average price (€)	724	513	440	440	410	400	385	310	305	278	269	260	257	210	190	150	150	125	120	120	110	110	100	100	100	100	83	-
Ranking	1	2	3	3	5	6	7	8	9	10	11	12	13	14	15	16	16	18	19	19	21	21	23	23	23	23	27	-

Average prices include VAT

2009–2012 European EPAC sales (EU 27)

(1,000 units)

Year	2006	2007	2008	2009	2010	2011	2012
EPAC Sales (x 1,000)	98	173	279	422	588	716	854
Evolution (%)	-	76,53	61,27	51,25	39,34	21,77	19,27

EPAC = Electric power-assisted cycle

2012 European EPAC sales and ranking (EU 27)

(1,000 units)

Country	Germany	The Netherlands	France	Italy	Austria	Denmark	Great Britain	Spain	Belgium	Sweden	Portugal	Czech Republic	Finland	Poland	Ireland	Lithuania	Slovakia	Slovenia	Greece	Luxembourg	Hungary	Bulgaria	Cyprus	Estonia	Latvia	Malta	Romania	EU 27
	EPAC Sales (x 1,000)	380	175	46	46	45	30	30	30	25	11	10	5	5	5	2	2	2	2	1	1	0	0	0	0	0	0	854
	Country share (%)	45	21	5	5	5	4	4	4	3	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	100	
	Country share (%)	1	2	3	4	5	6	6	6	9	10	11	12	12	12	15	15	15	15	19	19	21	22	23	23	23	23	100

EPAC = Electric power-assisted cycle

2012 Employment in the European bicycle and bicycle parts & accessories industries (EU27)

Country	Germany	Italy	The Netherlands	France	Poland	Bulgaria	Romania	Portugal	Czech Republic	Hungary	Belgium	Slovakia	Spain	Austria	Lithuania	Greece	Great Britain	Finland	Slovenia	Sweden	Cyprus	Denmark	Estonia	Ireland	Latvia	Luxembourg	Malta	EU 27
Bicycle Employment	2600	1600	1764	1000	1200	1387	400	690	460	500	258	280	300	300	250	130	50	60	10	80	0	0	0	0	0	0	0	13319
Parts & Accessories Employment	1300	1750	500	900	370	60	800	500	480	80	182	90	10	0	0	0	70	45	70	0	0	0	0	0	0	0	0	7207
Total	3900	3350	2264	1900	1570	1447	1200	1190	940	580	440	370	310	300	250	130	120	105	80	80	0	0	0	0	0	0	0	20526
Ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	19	21	21	21	21	21	21	21	

Country specific summaries:

France – The bicycle park is estimated at 25,000,000 units. Around 40% of the French population owns a bicycle. One of the main restraints of bicycle riding and purchasing development is the numbers of thefts, especially in big cities.

UK – The sales of electric bikes remain very slow – while under 20,000 units for the year it is noteworthy that the British Electric Bicycle Association (BEBA) has decided to join the Bicycle Association to make one consolidated group. There has been some speculation, by Mintel, that the market in the UK is growing and will continue to grow rapidly. We can find no support for this claim in the actual figures. The UK market has remained remarkably stable at about 3.6 m. units p.a. for the last six years.

The Netherlands – All types of bicycles have seen a drop in sales, but the electric bicycle is doing relatively well. In 2012 sales of electric pedal-assisted bicycles reached 175,000. The fact that the one millionth E-bike was sold this year is further proof of the popularity of this rather new product group. In terms of turnover, E-bikes have surpassed the city bike. With 16.9% of total sales, they have reached a turnover share of 42.1%. For dealers the E-bike turnover percentage has reached 43.5% and has become their most important sales segment. As bicycle consumers acquire more knowledge, they put a premium on advice, service and maintenance guarantees when buying a new bicycle. The average price consumers paid for an e-bike in 2012 is € 1,799.

A.3.0 Appendix 3: End of Life Vehicles Directive – exemption status screening

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
Lead as an alloying element				
1(a) Steel for machining purposes and batch hot dip galvanised steel components containing up to 0.35% lead by weight			Bicycle frame and fork; seat post; chain rings - have higher processing requirements and thus probably manufactured with other materials	Could be relevant for housing of electric components; or in other non-electrical components
1(b) Continuously galvanised steel sheet containing up to 0.35% lead by weight	Vehicles type approved before 1 January 2016 and spare parts for these vehicles	To expire before end of 2019 transition period		Substitution / elimination assumed possible by 2016.
2(a) Aluminium for machining purposes with a lead content up to 2% by weight	As spare parts for vehicles put on the market before 1 July 2005	Expired for new vehicles		Substitution / elimination are possible.
2(b) Aluminium with a lead content up to 1.5% by weight	As spare parts for vehicles put on the market before 1 July 2008	Expired for new vehicles		Substitution / elimination are possible.
2(c) Aluminium with a lead content up to 0.4% by weight	-1	This exemption shall be reviewed in 2015.	Frame	Relevance of substitution to be reviewed in 2015
3. Copper alloy containing up to 4% lead by weight	-1	This exemption shall be reviewed in 2015.	Possibly relevant for bearings and bushes though these appear to be covered by ELV exemptions 4(a) and 4(b) which have expired	Relevance of substitution to be reviewed in 2015

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
4(a) Bearing shells and bushes	As spare parts for vehicles put on the market before 1 July 2008	Expired for new vehicles	Bearing shells and bushes	Substitution / elimination are possible.
4(b) Bearing shells and bushes in engines, transmissions and air conditioning compressors	1 July 2011 and spare parts for vehicles put on the market before 1 July 2011	Expired for new vehicles	Bearing shells and bushes	Substitution / elimination are possible.
Lead and lead compounds in components				
5. Batteries	-1	This exemption shall be reviewed in 2015.	Assumed irrelevant, as batteries for electric vehicles are addressed separately as in Ex. 18 and as batteries understood to be out of scope of RoHS.	Relevance of substitution to be reviewed in 2015
6. Vibration dampers	Vehicles type approved before 1 January 2016 and spare parts for these vehicles	To expire before end of 2019 transition period		Substitution / elimination assumed possible by 2016.
7(a) Vulcanising agents and stabilisers for elastomers in brake hoses, fuel hoses, air ventilation hoses, elastomer/metal parts in the chassis applications, and engine mountings	As spare parts for vehicles put on the market before 1 July 2005	Expired for new vehicles		Substitution / elimination are possible.

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
7(b) Vulcanising agents and stabilisers for elastomers in brake hoses, fuel hoses, air ventilation hoses, elastomer/metal parts in the chassis applications, and engine mountings containing up to 0.5% lead by weight	As spare parts for vehicles put on the market before 1 July 2006	Expired for new vehicles		Substitution / elimination are possible.
7(c) Bonding agents for elastomers in powertrain applications containing up to 0.5% lead by weight	As spare parts for vehicles put on the market before 1 July 2009	Expired for new vehicles		Substitution / elimination are possible.
8(a) Lead in solders to attach electrical and electronic components to electronic circuit boards and lead in finishes on terminations of components other than electrolyte aluminium capacitors, on component pins and on electronic circuit boards	Vehicles type approved before 1 January 2016 and spare parts for these vehicles	To expire before end of 2019 transition period		Substitution / elimination assumed possible by 2016.
8(b) Lead in solders in electrical applications other than soldering on electronic circuit boards or on glass	Vehicles type approved before 1 January 2011 and spare parts for these vehicles	Expired for new vehicles		Substitution / elimination are possible.
8(c) Lead in finishes on terminals of electrolyte aluminium capacitors	Vehicles type approved before 1 January 2013 and spare parts for these vehicles	Expired for new vehicles		Substitution / elimination are possible.

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
8(d) Lead used in soldering on glass in mass airflow sensors	Vehicles type approved before 1 January 2015 and spare parts of such vehicles	To expire before end of 2019 transition period		Substitution / elimination assumed possible by 2015.
8(e) Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead)	-3	(3) This exemption shall be reviewed in 2014.	Possibly relevant for electric components.	Relevance of substitution to be reviewed in 2014
8(f) Lead in compliant pin connector systems	-3	(3) This exemption shall be reviewed in 2014.	Possibly relevant for electric components.	Relevance of substitution to be reviewed in 2014
8(g) Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages	-3	(3) This exemption shall be reviewed in 2014.	Possibly relevant for electric components.	Relevance of substitution to be reviewed in 2014
8(h) Lead in solder to attach heat spreaders to the heat sink in power semiconductor assemblies with a chip size of at least 1 cm ² of projection area and a nominal current density of at least 1 A/mm ² of silicon chip area	-3	(3) This exemption shall be reviewed in 2014.	Possibly relevant for electric components.	Relevance of substitution to be reviewed in 2014
8(i) Lead in solders in electrical glazing applications on glass except for soldering in laminated glazing	Vehicles type approved before 1 January 2016 and after that date as spare parts for these vehicles	To expire before end of 2019 transition period	Assumed irrelevant for bicycle components as main applications are connections to windshield and windows.	Substitution / elimination assumed possible by 2016.

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
8(j) Lead in solders for soldering in laminated glazing	-3	(3) This exemption shall be reviewed in 2014.	Assumed irrelevant for bicycle components as main applications are connections to windshield and windows.	Relevance of substitution to be reviewed in 2014
9. Valve seats	As spare parts for engine types developed before 1 July 2003	Expired for new vehicles		Substitution / elimination are possible.
10(a) Electrical and electronic components which contain lead in a glass or ceramic, in a glass or ceramic matrix compound, in a glass-ceramic material, or in a glass-ceramic matrix compound. This exemption does not cover the use of lead in: - glass in bulbs and glaze of spark plugs, - dielectric ceramic materials of components listed under 10(b), 10(c) and 10(d)		X (4) (for components other than piezo in engines)	Most probably not relevant.	May be relevant in electric components
10(b) Lead in PZT based dielectric ceramic materials of capacitors being part of integrated circuits or discrete semiconductors			Possibly relevant for electric components.	May be relevant in electric components
10(c) Lead in dielectric ceramic materials of capacitors with a rated voltage of less than 125 V AC or 250 V DC	Vehicles type approved before 1 January 2016 and spare parts for these vehicles	To expire before end of 2019 transition period		Substitution / elimination assumed possible by 2016.

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
10(d) Lead in the dielectric ceramic materials of capacitors compensating the temperature-related deviations of sensors in ultrasonic sonar systems	-3	(3) This exemption shall be reviewed in 2014.	Assumed irrelevant for bicycle components.	Relevance of substitution to be reviewed in 2014
11. Pyrotechnic initiators	Vehicles type approved before 1 July 2006 and spare parts for these vehicles	Expired for new vehicles		Substitution / elimination are possible.
12. Lead-containing thermoelectric materials in automotive electrical applications to reduce CO2 emissions by recuperation of exhaust heat	Vehicles type approved before 1 January 2019 and spare parts for these vehicles	To expire before end of 2019 transition period		Substitution / elimination assumed possible by 2019.
Hexavalent chromium				
13(a) Corrosion preventive coatings	As spare parts for vehicles put on the market before 1 July 2007	Expired for new vehicles		Substitution / elimination are possible.
13(b) Corrosion preventive coatings related to bolt and nut assemblies for chassis applications	As spare parts for vehicles put on the market before 1 July 2008	Expired for new vehicles		Substitution / elimination are possible.

Materials and components	Scope and expiry date of the exemption	Comments to scope and expiry date	Electric bicycle components of relevance	Conclusion
14. As an anti-corrosion agent of the carbon steel cooling system in absorption refrigerators in motor-caravans up to 0.75 weight-% in the cooling solution except where the use of other cooling technologies is practicable (i.e. available on the market for the application in motor caravans) and does not lead to negative environmental, health and/or consumer safety impacts		X	Understood to be irrelevant for Electric bicycles in lack of cooling system	Understood to be irrelevant for electric bicycles
Mercury				
15(a) Discharge lamps for headlight application	Vehicles type approved before 1 July 2012 and spare parts for these vehicles	Expired for new vehicles		Substitution / elimination are possible.
15(b) Fluorescent tubes used in instrument panel displays	Vehicles type approved before 1 July 2012 and spare parts for these vehicles	Expired for new vehicles		Substitution / elimination are possible.
Cadmium				
16. Batteries for electrical vehicles	As spare parts for vehicles put on the market before 31 December 2008	Expired for new vehicles	Batteries	Substitution / elimination are possible.

A.4.0 Appendix 4: Full evaluation of policy options

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Environmental impacts					
	=	=	=	+	between - and - -
Reduction in use of RoHS substances (impacts tied to use of hazardous resources)	Most benefits anticipated before 2019, slowly reducing as substitutes are found and exemptions become obsolete.	Deadlines of compliance are not affected; achieving compliance earlier is not assumed a result of the scenario but of progress of R&D at a different pace from business plan estimations.	Deadlines of compliance are not affected; achieving compliance earlier is not assumed a result of the scenario but of progress of R&D at a different pace from business plan estimations.	Deadlines of compliance are to be shifted for EEE newly in scope; achieving compliance earlier maybe possible in some cases, meaning that environmental impacts would have a shorter impact period. Assumed that in most cases this would result in more exemptions to avoid changes to business plans.	Reparability of non-complaint EEE newly in scope is made possible, resulting in production of non-compliant spare parts and cables, which shall require resources in terms of hazardous substances.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Reduction in use of RoHS substances (impacts tied to emissions, main focus on the end-of-life phase)	=	=	=	+	between - and - -
	Emissions of manufacture anticipated before 2019, slowly reducing as substitutes. Emissions from use shall vary in light of product life and may extend well beyond 2019, though slightly decreasing after the deadline.	Deadlines of compliance are not affected; achieving compliance earlier is not assumed a result of the scenario but of progress of R&D at a different pace from business plan estimations.	Deadlines of compliance are not affected; achieving compliance earlier is not assumed a result of the scenario but of progress of R&D at a different pace from business plan estimations.	Deadlines of compliance are to be shifted for EEE newly in scope; achieving compliance earlier maybe possible in some cases, meaning that emissions shall decrease earlier in some cases, having a shorter impact period. Assumed that in most cases this would result in more exemptions to avoid changes to business plans.	Reparability of non-complaint EEE newly in scope is made possible, resulting in production of non-compliant spare parts and cables, which may cause additional emissions, particularly tied to treatment of WEEE. Impact may vary, strongly depending on substance and application as well as on efficiency of substance waste management)
Environmental impacts tied to EEE reaching end of use life early (reparability limitation)	=	=	=	+	+++
	Reparability of non-compliant articles to result in some cases in early end of life and in others in export to non-EU countries for repair and resale	Reparability aspect to remain unchanged.	Reparability aspect to remain unchanged.	Reparability aspect to remain unchanged, however non-compliance deadline is earlier, meaning that this aspect would lose relevance earlier, resulting in slightly less negative impacts in terms of magnitude and time.	Reparability of non-complaint EEE newly in scope is made possible, resulting in less products being scrapped earlier or shipped away to be repaired and resold in non EU countries.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Environmental impacts tied to EEE reaching end of market life early secondary market operation limitation)	=	+	++	++	?
	Secondary market operations of non-compliant articles banned after 22.7.2019. In a small number of cases, could result in early end-of-life, in most cases assumed to be exported beyond the EU and thus to only have distributional affects in terms of shifting environmental impacts elsewhere.	Status of EEE newly in scope shall not change. Cat. 8 and 9 products shall have certainty in terms of secondary market operations for non-compliant articles placed on the market before 2014/2016/2019. Thus possible negative impacts for these products in terms of early end-of-life and distributional affects to be irrelevant.	Deadlines shall not change, however secondary market operations aspects are eliminated.	Deadlines earlier. Secondary market operation aspects are eliminated, regardless of coming into scope. The fact that this may be relevant for less articles in light of earlier compliance is not necessarily to be tied with environmental benefits as products shall be replaced with compliant ones and RoHs substance aspect already accounted for above.	Aspect assumed irrelevant for Option.
Summary	=	+	++	between + and ++	between - - and +++
		Small benefit in terms of Cat. 8 and 9 secondary market applicability (reparability is already granted)	Moderate benefit in light of solution for secondary market issues.	Small benefit regarding all aspects; Moderate benefit in light of solution for secondary market issues.	Regarding use of RoHs substances, low to moderate negative impact expected; Significant benefit however in terms of elimination of early end-of-life which is expected to result in the use of less resources for new products to replace non-functional ones.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Economic Impacts					
Costs of compliance with substance restrictions (substitution) - impacts to manufacture / R&D	=	=	=	-	+
	Costs tied to research of substitutes, redesign and adaptation of manufacture.	Deadlines unchanged, no cost difference expected.	Deadlines unchanged, no cost difference expected.	Earlier deadline shall result in costs of reallocation of resources to support change of business plans for supporting early transition to compliance.	Less effort needed to allow repair of non-compliant products with compliant parts resulting in reduced costs of compliance.
Possible distortions of internal market	=	=	=	-	?
	Most effects relevant for manufacturers producing both regulated and non-regulated products who may adapt all production, shift manufacture of some components to supply chain or change product portfolio to avoid compliance cost, losing the respective clientele.	Deadlines unchanged, no cost difference expected.	Deadlines unchanged, no cost difference expected.	Earlier compliance for EEE newly in scope - costs to incur earlier and be less distributed over time, regarded as more significant negative impact.	Distributional affect tied to changes in product portfolio tied with compliance. As policy relevant only for non-compliant products, this is irrelevant to policy option.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Costs of compliance with substance restrictions - impacts to administrative costs of industry (training / process of exemptions)	=	=	=	-	+
	Costs to remain similar with possible one-off costs related to articles newly coming into scope.	Compliance dates shall not change so no difference expected.	Compliance dates shall not change so no difference expected.	Change in compliance date of EEE newly in scope will mean one-off costs arrive earlier and are distributed over less time.	Reduced costs in terms of screening where non-reparability shall require updates in products to allow use of non-compliant spare parts and where exemptions may allow further use.
Administration costs for public authorities	=	between = and +	+	Between = and -	+
	Limited costs expected in light of need to update activities in line with Directive amendments and in light of growth of activity volume when new categories come into scope.	Deadlines for compliance shall not change -slight cost decrease as resolving market limitations for Cat. 8 & 9 shall mean less market surveillance for this issue are needed.	Deadlines for compliance shall not change - small cost decrease as resolving market limitations for Cat. 8 & 9 and EEE newly in scope shall mean less market surveillance for this issue are needed.	Small cost decrease as resolving market limitations for Cat. 8 & 9 and EEE newly in scope shall mean less market surveillance for this issue are needed, balanced off with larger volume of market surveillance tied to earlier coming into scope of EEE newly in scope. Impacts are to cancel one another out or to result in slight costs as compliance regards all products newly in scope and limited marketability only regards some.	Less costs for market surveillance in light of provision for use of non-compliant components (non-use does not need to be ensured).

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Possible changes to market structure (including wider impact on trade with non-EU countries)	=	=	=	-	?
	limited costs expected where certain applications (niche technologies / compliant components) only manufactured in certain countries	Changes expected are irrelevant in respect of resolving market issues for Cat. 8 & 9.	Changes expected are irrelevant in respect of resolving market issues for EEE newly in scope and Cat. 8 & 9.	Earlier compliance date may result in possible costs to incur early. Difference is between negligible and small as for most products compliance would be achieved at same time. Changes expected are irrelevant in respect of resolving market issues for EEE newly in scope and Cat. 8 & 9.	Understood to be irrelevant for policy option as manufacture shall remain where manufacture of original components was performed.
Impacts on consumer supply - in light of compliance with substance restriction	=	=	=	+	?
	Compliance requirement may result in some cases to loss of product range, though expected to be a negligible impact as in most cases either substitutes are available or exemptions will be used until they are found and applied.	No changes expected as deadlines shall not change and reparability and market limitations are irrelevant.	No changes expected as deadlines shall not change and reparability and market limitations are irrelevant.	Slight changes may be relevant in light of earlier compliance date - changes in supply in light of limitation of substitutes shall be resolved earlier in terms of replacing products where production has ceased; reparability and market limitations are irrelevant.	General compliance with substance restrictions of products irrelevant for policy option.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Impacts on consumer product supply - in light of limited secondary market operations (limited supply of common leasing and renting products or supply of products with low quality)	=	+	++	++	?
		No changes expected for EEE newly in scope; costs for Cat. 8 & 9 tied to limited marketability of products to be resolved, meaning small benefit.	No changes in deadlines but limited marketability of products to be resolved, meaning moderate benefit.	Despite change in deadlines, resolving limited marketability of products expected to result in moderate benefit as time of compliance less relevant.	Marketability of products irrelevant for policy option
Impacts on consumer product value - in light of limited reparability	=	=	=	+	++
		No changes expected for EEE newly in scope; reparability already available for Cat. 8 & 9 so no change expected.	No change to deadlines and reparability issues so no change expected.	Deadline change for EEE newly in scope. Reparability impacts to be smaller as compliance assumed earlier resolving reparability aspect.	Reparability aspect is resolved, subsequently causing no consumer cost in this regard.
Impacts on consumers: in light of warranty applicability of product	=	=	=	+	++
	Impacts relevant where repair results in shorter warranties or in receiving newer or better products to replace faulty ones.	No changes expected for EEE newly in scope; costs for Cat. 8 & 9 only regard limited marketability of products which is not relevant to warranty issues.	Deadlines of compliance and reparability aspect without change. No expected impact on warranties.	Deadline change for EEE newly in scope. Warranty impacts to be smaller as compliance assumed earlier resolving reparability aspect.	Reparability aspect is resolved, subsequently solving warranty aspects.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Summary	=	between = and +	+ or ++	- (industry, and authorities) ++ (consumers)	between + and ++
		In light of lower costs for market surveillance by public authorities and benefits for consumers in terms of supply of products in secondary market operations.	In light of lower costs for market surveillance by public authorities and moderate benefits for consumers in terms of supply of products in secondary market operations.	Higher costs for industry regarding all aspects; Slight higher costs for public authorities; and moderate benefits for consumers in terms of supply of products in secondary market operations as well as smaller negative impacts tied to product value and supply.	Small benefits for industry and authorities; moderate benefits for consumers – relevant for all indicators.
Social Impacts					
Impacts on employment	=	=	=	+	++
	Distribution of employment opportunities only expected to change where niche technologies or components are manufactured only in specific countries - direction unclear but probably not significant. Employment opportunities expected on the short term in light of effort towards compliance. Loss of opportunities on the short term	Deadlines of compliance are not affected. Secondary market not expected to result in change of employment opportunities.	Deadlines of compliance are not affected. Secondary market not expected to result in change of employment opportunities.	Deadline of compliance of EEE newly in scope is earlier, possibly resulting in some employment opportunities arriving earlier, but being short term. This could result in small benefit. Secondary market not expected to result in change of employment opportunities.	Positive impacts relevant for repair operations in light of additional work on repair of non-compliant products.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
	where reparability impacted.				
Impacts on consumers behaviour	=	Between = and +	between + and ++	between + and ++	++
	Impacts relevant where product supply or product quality is impacted in light of shift of consumers to other products (short life or compliant).	Deadlines of compliance are not affected and EEE newly in scope has same issues; Solution of secondary market aspects for Cat. 8 & 9 may result in some benefits in terms of impacts of product market life. Small benefit possible.	Secondary market aspects shall become obsolete, resulting in moderate benefits for EEE newly in scope and Cat. 8 & 9 products.	Secondary market aspects shall become obsolete, resulting in moderate benefits for EEE newly in scope and Cat. 8 & 9 products. Earlier compliance not expected to make a difference as benefits are relevant for non-compliant products. If any, benefits may be smaller.	Impacts tied with non-reparability shall be resolved, thus impacts on consumer behaviour in light of reparability aspects not expected. This may also be reflected in extended consumer warranties for long life products, creating a shift back to long life products.
Impacts on health	=	=	=	+	-
	Impacts mainly related to the reduction of RoHS substances used in manufacture of EEE, expected to incur mainly before compliance deadlines.	Deadlines of compliance are not affected; difference in impact not expected.	Deadlines of compliance are not affected; difference in impact not expected.	Deadline of compliance of EEE newly in scope is earlier and may thus result in a faster reduction of health impacts associated with use of RoHS substances. Benefit is short termed.	Negative impact in light of use of RoHS substances in manufacture of non-complaints spare parts and cables. This may be balanced out with impacts of reduced manufacture of replacement equipment for articles that have reached end-of-life early.

	Option 1	Option 2	Option 3	Option 4	Option 5*
	Baseline scenario	Cat. 8 & 9 scenario	2019 scenario	2017 scenario	Spare-Part scenario
Summary	=	Between = and +	between + and ++	between + and ++	++
		Low positive impacts in light of impacts on consumer behaviour.	Positive impact tied to market use of all products.	Positive impact tied to market use of all products as well as possible positive impacts on the job market.	Positive impact on employment in repair enterprises.
Note: *Option 5 impacts are only relevant in the comparison of reparability aspects, which are not available to non-compliant EEE newly in scope in any of the other options.					

A.5.0 Appendix 5: Statistic data for the manufacture of lighting articles in the EU 27

To provide some indication as to the volume of sales that may be relevant for this case, information was extracted from Eurostat⁹⁶ as to the value of sales of lighting applications in the EU 27. Data is based on NACE classifications for various lighting applications (e.g., lamps; fixtures, etc.).

The following codes were found relevant lighting application production. An indication is provided as to the relevance for RoHS:

Code	Relevance to EEE	Description
27401100	Irrelevant	Sealed beam lamp units
27401250	Irrelevant	Tungsten halogen filament lamps for motorcycles and motor vehicles (excluding ultraviolet and infrared lamps)
27401293	Irrelevant	Tungsten halogen filament lamps, for a voltage > 100 V (excluding ultraviolet and infra-red lamps, for motorcycles and motor vehicles)
27401295	Irrelevant	Tungsten halogen filament lamps for a voltage ≤ 100 V (excluding ultraviolet and infrared lamps, for motorcycles and motor vehicles)
27401300		Filament lamps of a power ≤ 200 W and for a voltage > 100 V including reflector lamps (excluding ultraviolet, infrared lamps, tungsten halogen filament lamps and sealed beam lamp units)
27401460	Irrelevant	Filament lamps for motorcycles or other motor vehicles excluding sealed beam lamp units, tungsten halogen lamps
27401490		Filament lamps n.e.c.
27401510		Fluorescent hot cathode discharge lamps, with double ended cap (excluding ultraviolet lamps)
27401530		Fluorescent hot cathode discharge lamps (excluding ultraviolet lamps, with double ended cap)
27401550		Other discharge lamps (excluding ultraviolet lamps)
27401570	Irrelevant	Ultraviolet or infrared lamps, arc lamps
27402100		Portable electric lamps worked by dry batteries, accumulators or magnetos (excluding for cycles or motor vehicles)
27402200	Irrelevant	Electric table, desk, bedside or floor-standing lamps
27402300		Non-electrical lamps and lighting fittings
27402400		Illuminated signs, illuminated name-plates and the like (including road signs)
27402500	Irrelevant	Chandeliers and other electric ceiling or wall lighting fittings (excluding those used for lighting public open spaces or thoroughfares)

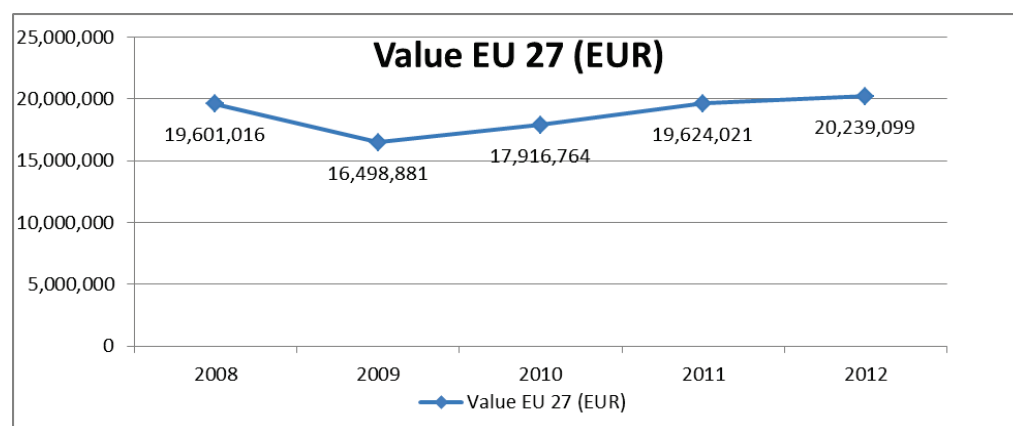
⁹⁶ EUROSTAT Statistics on the production of manufactured goods for the years 2008-2012, available under http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel

Code	Relevance to EEE	Description
27403100	Irrelevant	Photographic flashbulbs, flashcubes and the like
27403200	Irrelevant	Lighting sets for Christmas trees
27403300	Irrelevant	Searchlights and spotlights (including for stage sets, photographic or film studios)
27403910	Irrelevant	Electrical lighting or visual signalling equipment for motor vehicles (excluding electric filament or discharge lamps, sealed beam lamp units, ultraviolet, infrared and arc lamps)
27403930	Irrelevant	Electric lamps and lighting fittings, of plastic and other materials, of a kind used for filament lamps and tubular fluorescent lamps
27404100	Irrelevant	Parts for electric filament or discharge lamps (including sealed beam lamp units, ultraviolet or infrared lamps, arc lamps)
27404230		Parts of portable electric lamps worked by dry batteries, accumulators or magnetos (excluding for cycles or motor vehicles)
27404250		Parts (excluding of glass or plastics) of lamps and lighting fittings, etc

The following data was relevant for sales of lighting articles in the EU 27. The evolution is calculated as the difference in growth in comparison with the previous year.

Year	All lighting articles Value EU 27 (thousands of €)
2008	19,601,016
2009	16,498,881
2010	17,916,764
2011	19,624,021

Sales (in thousand €) data are used to show the trend of growth in the lighting industry in the diagram below.



A.6.0 Appendix 6: Statistic data for the manufacture of generating sets in the EU 27

To provide some indication as to the volume of sales that may be relevant for generating sets (GENSETs), information was extracted from Eurostat⁹⁷ as to the value of sales of GENSETs in the EU 27. Data is based on NACE classifications falling under 27.11 Manufacture of electric motors, generators and transformers, which refer to generating sets.

The following codes were found relevant in this regard.

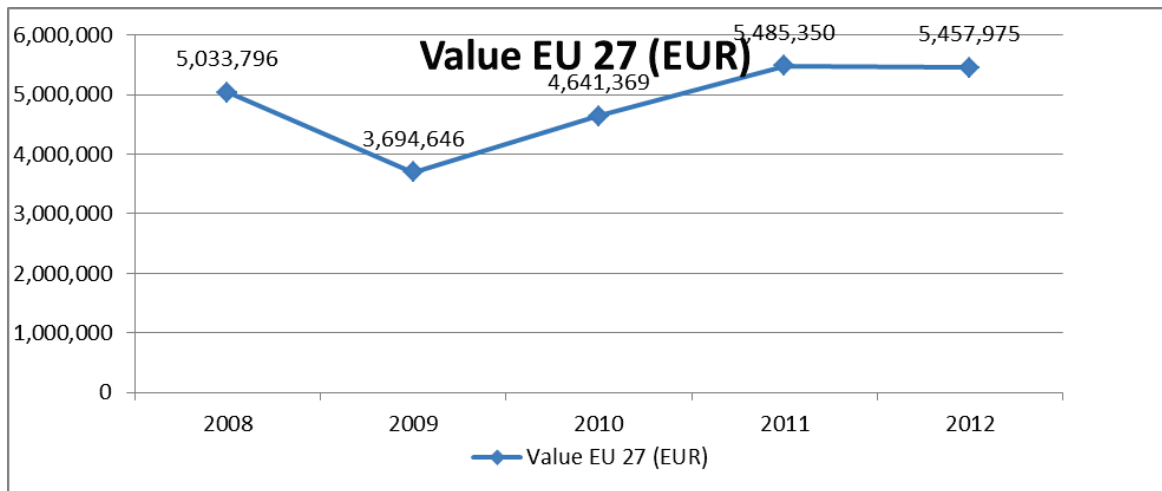
Code	Description
27113110	Generating sets with compression-ignition internal combustion piston engines, of an output ≤ 75 kVA
27113130	Generating sets with compression-ignition internal combustion piston engines of an output > 75 kVA but ≤ 375 kVA
27113150	Generating sets with compression-ignition internal combustion piston engines of an output > 375 kVA but ≤ 750 kVA
27113170	Generating sets with compression-ignition engines of an output > 750 kVA
27113233	Generating sets with spark-ignition internal combustion piston engines of an output ≤ 7.5 kVA
27113235	Generating sets with spark-ignition internal combustion piston engines of an output > 7.5 kVA
27113250	Generating sets (excluding wind-powered and powered by spark-ignition internal combustion piston engine)

The following data was relevant for sales of GENSETs in the EU 27. The evolution is calculated as the difference in growth in comparison with the previous year.

Year	All GENSETs Value EU 27 (thousands of €)
2008	5,033,796
2009	3,694,646
2010	4,641,369
2011	5,485,350
2012	5,457,975

Sales (in thousand €) data are used to show the trend of growth in the GENSETs industry in the diagram below.

⁹⁷ EUROSTAT Statistics on the production of manufactured goods for the years 2008-2012, available under http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel



A.7.0 Appendix 7: Statistic data for the manufacture of toys in the EU 27

To provide some indication as to the volume of sales that may be relevant for this case, information was extracted from Eurostat⁹⁸ as to the value of sales of toys in the EU 27. Data is based on NACE classifications, which in the case of toys are understood not to fall under the group classifications of EEE.

The following codes were found relevant toy production. An indication is provided as to the relevance for RoHS:

Code	Relevance to EEE	Description
32401100		Dolls representing only human beings
32401200		Toys representing animals or non-human creatures
32401300		Parts and accessories for dolls representing only human beings
32402000		Toy trains and their accessories; other reduced-size models or construction sets and constructional toys
32403100		Wheeled toys designed to be ridden by children (excluding bicycles); dolls' carriages
32403200	Irrelevant	Puzzles
32403920		Toy musical instruments and apparatus; toys put up in sets or outfits (excluding electric trains, scale model assembly kits, construction sets and constructional toys, and puzzles); toys and models incorporating a motor; toy weapons
32403940		Other toys of plastics
32403960	Irrelevant	Toy die-cast miniature models of metal
32403990		Other toys n.e.c.
32404100	Irrelevant	Playing cards
32404210	Irrelevant	Articles and accessories for billiards (excluding mechanical counters, time meters and cue racks)
32404230		Games operated by coins, banknotes, discs or other similar articles (excluding bowling alley equipment)
32404250		Electric car racing sets having the character of competitive games

The following data was relevant for sales of toys in the EU 27. The evolution is calculated as the difference in growth in comparison with the previous year.

⁹⁸ EUROSTAT Statistics on the production of manufactured goods for the years 2008-2012, available under http://epp.eurostat.ec.europa.eu/portal/page/portal/prodcom/data/tables_excel

Year	All toys Value EU 27 (thousands of €)	Evolution
2008	5,223,780	not calculated
2009	5,013,937	-4%
2010	6,549,526	31%
2011	6,378,285	-3%
2012	7,343,780	15%

A.8.0 Appendix 8: Summary of stakeholder contributions

Stakeholder	Product and/or categories to which contribution refers	View of proposed policy scenarios	Comments
GAMBICA – the UK Association for Instrumentation, Control, Automation and Laboratory Technology	Particularly concerned with industrial products/equipment falling under Category 9.	Support Option 3 and Option 5. Option 2 is also supported, though GAMBICA comment that a solution that addresses all affected EEE would be preferable.	<i>Urge the Commission to act quickly in order to remedy the unintentional consequences of Article 2(2) and remove the uncertainty that is currently affecting industry and consumers.</i>
EUROMOT – The European Association of Internal Combustion Engine Manufacturers	Concerned with all equipment powered by internal combustion engines, assumed to fall under Category 11.	Support Option 3 and Option 5.	Note that most engine-powered equipment is covered by exclusions under Article 2 (4) and that engine powered equipment above 1000 V for alternating current and 1500 V for direct current is not in scope of the RoHS Directive.
AMCHAM EU – American Chamber of Commerce to the EU	General contribution with some comments referring specifically to Cat. 8 and 9 articles.	Contribution consists of contribution to BIOIS Project, prepared in 2012, thus proposed policy options are not mentioned.	AMCHAM EU support the proposal to change Article 2.2 to replace the term “making available” with the term “the placing on the market of the product”. It is also understood that a spare parts provision is supported to allow refurbishment and reuse of equipment.
COCIR – European Coordination of the Radiological, Electromedical and Healthcare IT Industry	Particularly concerned with medical devices falling under Cat. 8.	COCIR explain that Option 2 is suited to avoid unwanted impacts on Category 8 products, however, it is further explained that there are other products for medical use which are not strictly medical devices which can fall under Cat. 11 which would be affected negatively by Article 2.2 (i.e. equipment for	COCIR explains its position that medical devices are not affected by Art. 2.2 of RoHS 2

Stakeholder	Product and/or categories to which contribution refers	View of proposed policy scenarios	Comments
		training). Therefore COCIR believes that Options 3 and 4 are preferable. COCIR does not express an opinion as to Option 5.	
Eucomed and EDMA, the industry associations representing the medical devices (MD) and in vitro diagnostic (IVD) medical devices sectors respectively	Represent manufacturers of CE-marked IVDs and MDs, i.e. products which fall under Cat. 8. Also refer to similar products in the medical veterinary and forensic fields as well as 'medical devices' which are intended for research or training purposes, which might fall under Cat. 11.	Support Option 3 and Option 5. Option 2 is also supported, though as a secondary preference.	Request that the economic, legal and environmental impact of Article 2.2 on the MD and IVD industries as well as on their consumers –hospitals, laboratories and ultimately patients – be taken into account.
EGMF the European Garden Machinery industry Federation	Refer to petrol driven garden equipment falling under Cat. 11.	Support Options 3 and 5 as long as such incorporation is consistent with the principles of the EU Treaty and the New Legislative Framework (NLF).	
JBCE – the Japan Business Council in Europe	Concerned with all products to be impacted by current legal text.	JBCE supports the combination of both Scenario 3 and 5	
LEU – LightingEurope	Refer to articles with an integrated lighting function	Do not refer to the proposed policy options.	Are concerned with impacts to incur where manufactures decide not to include lighting in their products.
Orgalime – the European Engineering Industries Association	Concerned with all products to be impacted by current legal text.	Support Options 3 and 5 as long as such incorporation is consistent with the principles of the EU Treaty and the New Legislative Framework (NLF).	Warn that the proposed earlier compliance date in Option 4 risks a direct conflict with the general rule of non-retroactivity of legal obligations.
KEMI – the Swedish Chemicals Agency	Concerned with all products to be impacted by current legal text.	Support Options 3 and 5.	Further propose the addition of a time limit for resale of equipment that has never been operated by an end user.

Stakeholder	Product and/or categories to which contribution refers	View of proposed policy scenarios	Comments
TechAmerica Europe represents leading European high-tech operations with US parentage	Concerned with all products to be impacted by current legal text.	Support Option 3 and Option 5. Option 2 is also supported, though as a secondary preference.	Regarding the proposed earlier compliance date in Option 4, state that given the time needed by Member States to draft, negotiate, publish and then transpose such a requirement, it is highly likely that this scenario would result in industry not being allowed a sufficient transition period to bring products into compliance.
EUnited Cleaning – the Association of European Cleaning Machines Manufacturers	Refer to cleaning machines.	Contribution consists of document sent to the EU COM at the time of the Stakeholder Consultation, with relevance to the policy options discussed, however none of the options are specifically referred to as document not prepared as a contribution.	State that it will be necessary to keep the compliance deadline at 21 July 2019 in order to give the industry sufficient time to find suitable solutions for substituting RoHS substances and achieving compliance.
SEMI – the global industry association representing the manufacturing supply chain for the semiconductor and related industries	Refer to semiconductor manufacturing equipment not covered by the Article 2(4) large scale exclusions.	SEMI believes that the RoHS text should be revised on the basis of Options 3 and 5. SEMI further suggest keeping Article 2(2) and modifying it as follows: <i>Without prejudice to Article 4(3) and 4(4), Member States shall provide that EEE that was outside the scope of Directive 2002/95/EC, but which would does not comply with this Directive, may nevertheless continue to be made available placed on the market until 22 July 2019.</i>	Explain that such equipment has an active secondary market, which would also apply to equipment moved between manufacturing sites of the same corporate enterprise when these are in different member states, as ownership is transferred from one legal entity to another.