Final Meeting of the Technical Working Group for the EMAS Sectoral Reference Document on Best Environmental Management Practice in the Electrical and Electronic Equipment Manufacturing Sector

Minutes of the meeting

Brussels, 09-10 February 2016

These minutes of the meeting were developed by the Joint Research Centre of the European Commission with the support of Öko-Institut e.V**.**

Joint Research Centre – Circular Economy and Industrial Leadership Unit

C/ Inca Garcilaso 3, Edificio Expo, 41092 Seville, Spain
JRC-EMAS-SRD@ec.europa.eu

http://susproc.jrc.ec.europa.eu/activities/emas/index.html

Contents

1. Opening of the Workshop and introduction of experts

The JRC opened the session and welcomed the participants to the final meeting of the Technical Working Group (TWG) for the development of the EMAS Sectoral Reference Document for the Electrical and Electronic Equipment (EEE) manufacturing sector. The meeting agenda (attached in Annex 1) was presented and agreed by the participants.

The TWG members introduced themselves and summarised their experience in environmental sustainability in the EEE sector (the list of participants is attached in Annex 2). It was agreed to use first names to refer to the different TWG members.

JRC explained that the BEMP process on EEE started in January 2014 and will be completed in 2016. Although this workshop is the final physical meeting of the TWG members, it is not the end of the process, since there is still ample opportunity for the TWG members to provide inputs and comment.

2. Adoption minutes of the kick-off meeting

The minutes of the TWG kick-off meeting were approved with no comments. JRC informed that they will be uploaded on the project website[1].

3. Introduction to the concept of Best Environmental Management Practices and purpose of the meeting

JRC introduced the framework of the EMAS Regulation[2]. According to this Regulation, the European Commission will develop, in consultation with stakeholders and member states, Sectoral Reference Documents (SRD) comprising Best Environmental Management Practices (BEMP), environmental performance indicators and benchmarks of excellence. The aim of the SRDs is to describe with concrete measures what organisations of a given sector can do to improve their environmental performance and minimise their environmental impact.

It was stressed that the BEMP approach has a voluntary character and thus the implementation of the best practices described in the SRDs is not legally binding. However, SRDs have to be taken into account by companies that are registered with EMAS. In addition to this, the BEMPs, indicators and benchmarks in the SRDs are designed to be relevant and worthwhile to consider for any company aiming to improve its environmental performance.

Currently, BEMPs have been developed / are being developed for 11 different sectors[3]. Overlapping between these sectors is avoided as much as possible. For example, the BEMPs for the telecommunication and ICT services sector have their focus on services (user of ICT equipment side), whereas the EEE BEMPs are designed for EEE manufacturers.

---

1 The website is: http://susproc.jrc.ec.europa.eu/activities/emas/eeem.html

2 A copy of the presentations used in this and in all the following sections is given in Annex 3.

3 See Annex 3 for more details.

As integral part of the BEMP concept, JRC introduced[4] the concepts of Environmental Performance Indicator (EPI) and Benchmark of Excellence (BoE):

- EPI are designed to capture the progress that is made in improving the environmental performance at the process level; they must already be used in industry or derived from existing data / metrics; furthermore, they shall be as specific as possible in order to enable comparison against themselves (over time) and corresponding benchmarks.
- BoE are not aiming to quantify 'the best' available environmental performance, but shall be achievable by top performers ("best 10%"); they are not targets for every organisation to meet but rather a measure of what is possible under certain circumstances.

During the discussion of this item it was clarified that limits to applicability of BoE do always exist. Thus, the applicability of each BEMP, and, therefore, of the related BoE, need to be described as clearly as possible.

The purpose and goals of the meeting were specified by JRC as follows:

- Refine the list and concept of all the best practices;
- Draw conclusions on EPI and BoE;
- Identify gaps and information needs;
- Get further feedbacks and inputs to finalise the work.

Concerning the timeline of the process, the following schedule was given:

- Based on the discussion and agreements of this meeting, TWG members are invited to provide input until end of March 2016;
- JRC will draft a *Best Practice Report* on the basis of the *Background Report* by Öko-Institut and the input of TWG members (later in 2016);
- Finally the *SRD* itself (being a document of only about 30 pages) will be derived from the *Best Practice Report* and go through the legislative process for adoption as Commission decision (adoption expected by June 2017).

During the discussion, a major clarification need was expressed on how EMAS and specifically the EMAS SRD for EEE manufacturing are embedded in the overall EU policy landscape for this sector (e.g. RoHS, Ecodesign, REACH, WEEE, Type I Ecolabels, PEF/ OEF). This issue had already been raised during the TWG kick-off-meeting. For clarification, DG ENV presented a schematic diagram[5] that shows a mapping of the different existing EU policy instruments that are relevant for the electrical and electronic equipment manufacturing sector. According to this schematic diagram, EMAS aims to stimulate and promote environmental performance improvements on an organisational level with a voluntary approach, whereas e.g. ecodesign is a mandatory tool for improving the environmental performance of products.

Furthermore, a TWG member asked how the inventory for best practice in the EEE sector was identified. Martin (Öko-Institut) explained that, as a starting point for the Background Report, Öko-

[4] See Annex 3 for more details.

[5] http://susproc.jrc.ec.europa.eu/activities/emas/documents/EEE_policy_instrument_mapping.pdf

Institut screened existing frontrunner approaches by revising existing environmental declarations of companies registered according to EMAS, and other environmental reports. Furthermore, three different filters (component filter, geographical filter, environmental filter) were applied[6]. The JRC explained that the list of best practices currently being discussed is the result of the discussions held at the kick-off meeting, based on the initial proposals from the Background Report prepared by Oeko-Institut, and it will be further validated and, if needed, modified/completed during the current final meeting of the technical working group.

4. BEMPs for manufacturing processes and operations

4.1. Energy-efficient cleanroom technology

The concept of this BEMP was agreed by the TWG.

Also the EPI was accepted in principle: kWh/cm^2 of processed silicon wafer was confirmed to be a useful metric for the semiconductor industry. However, additional research needs to confirm whether introducing kWh/m^2 (based on the area of the room itself) as a complementary EPI would be sensible.

For the BoE, whether the air change rate is actually the best metric available needs to be verified. Thus, **Silke** offered to send the reference of a CEMATEC publication on energy benchmarking. Furthermore, it was noted that manufacturers of cleanroom systems (like Meissner + Wurst group) could be asked for input.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.2. Energy-efficient cooling

The concept of this BEMP was agreed by the TWG. However, JRC asked for further inputs and feedback from experts on this topic, especially among the companies represented in the TWG.

One of the aspects to be investigated is the opportunity to broaden the technological portfolio of this BEMP by including heat recovery in ventilation (see preparatory study for Eco design lot 6). **Mihai** will provide comments and further information in this respect.

It was also noted that the currently proposed EPI (i.e. COP) may not capture system level efficiency; thus, reintroducing qualitative metrics, such as whether free cooling is implemented, could be considered.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

---

[6] See Background Report by Öko-Institut (http://susproc.jrc.ec.europa.eu/activities/emas/documents/BEMP_EEE_BACKGROUND_REPORT_FINAL_April-2015.pdf) for more details.

4.3. Energy efficient soldering

There was only limited discussion on this BEMP, mainly because companies represented in the TWG that operate soldering equipment were not present in this meeting. **Philippe** volunteered to put JRC in contact with European Institute of PCB (Mr Alan Morgan) in order to get more feedback.

Again, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.4. Substitution and optimised use of VOC based solvents

The concept of this BEMP was approved by the TWG. However, there was a discussion about whether solvent recovery should be carried out on-site (as proposed in the Background Report) or whether external (outsourced) recovery can be considered as equally effective in terms of environmental performance. Martin answered that when opting for on-site recovery, transportation of potentially dangerous liquids can be avoided and this is an additional environmental benefit.

It was also decided that JRC would liaise with JRC BREF team working on solvent BREF concerning possible coverage of this BEMP in the BREF context in order to avoid overlaps.

Additionally, the TWG identified the need to improve the applicability section of this BEMP. **Silke** provided written comments in this respect.

Concerning BoE, it was noted that the proposed 75% refers to on-site recovery, but corresponds to what is technically feasible. It needs to be reflected upon in economic terms.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.5. On-site recycling of metals in process chemicals

There was a discussion among TWG members concerning on-site/off-site issue for this BEMP. Again, on-site recovery bears additional benefits because otherwise used etching agents need to be transported by road transport of dangerous goods. However, it was decided to mention also external recovery, especially for companies below the threshold of 60 tons of recycled copper per year. According to the Background Report this is the minimum value for ensuring a pay-back time lower than 18 months for on-site recovery.

In addition to this, TWG members identified the need for JRC to investigate the relevance of minimum recovery rates for this BEMP. In particular, it needs to be decided if a minimum recovery rate shall be added to the BoE. Within this context, WEEE recycling rates could be considered for guidance. **Stéphane** will try to provide data on recovery rates of copper and other precious metals (e.g. Au, PGM) from process chemicals.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.6. Water savings and recovery in cascade rinsing systems

There were no comments from the TWG members on this BEMP.

TWG members (especially companies that apply cascade rinsing systems and were not present in this meeting) will be asked to provide additional feedback on alternatives to UV lamps for controlling germ contamination. The Background Report mentioned a new technology for this purpose based on antimicrobial contact catalyst and it needs to be evaluated if this technology has already been implemented by front-running companies (besides the company already mentioned in the Background Report).

Again, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.7. Minimising perfluorocompounds emissions

There was general agreement on the concept of this BEMP.

However, some of the terminology used needs to be corrected. This refers to the wording 'point-of-use abatement' and 'end-of pipe approach' in order to align the BEMP to how these terms are commonly used in semiconductor industry. **Silke** will provide input in this respect.

Michael mentioned new techniques developed by Solvay referring to substitution of PFC and remote plasma cleaning and will send detailed information. Due to their emerging character, they will not be mentioned within this BEMP, but in a special section on emerging techniques.

The proposed BoE was agreed by TWG members.

4.8. Rational and efficient use of compressed air

The concept of this BEMP, which has been updated since the TWG kick-off meeting based on stakeholder input, was approved. It was agreed that ISO 11011 needs to be mentioned more prominently in the text - not just as a footnote.

Concerning the proposed BoE it was noted that this metric should be defined as '<0.11 kWh/m^3 for a compressed air system operation delivered at approx. 6.5 bars.' At first sight, Jenny considers this value to be achievable, but this needs to be evaluated. Thus, **Jenny** will compile figures across the industry in Europe and send feedback by mid-March 2016.

As an additional EPI the following metric was proposed in order to monitor the elimination of leakages in the compressed air system: 'Time during which the compressor keeps running after all air consumers are switched off'. A corresponding BoE of zero seconds was also discussed.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.9. Protecting and enhancing biodiversity

Compared to the Background Report, this BEMP was extended in scope to include measures to protect and enhance biodiversity not only at manufacturing sites but also across the supply chain.

The TWG members supported this BEMP but suggested that the dimension of supply chain management (indirect impacts on biodiversity) is worthwhile to elaborate further on, preferably within a separate BEMP, where the key tools to assess biodiversity performance at the level of suppliers need to be identified.

In terms of EPI, the proposed qualitative indicators (Y/N) shall be assessed; more practical examples (e.g. purchasing at certified suppliers) are considered to be helpful. Also biodiversity indicators used in GRI (Global Reporting Initiative) may be an interesting contribution and should be reviewed, since they apply a cross-sector approach. The area of land used (expressed in m^2 as a core EMAS indicator for biodiversity) could be mentioned too.

Moreover, it was noted that the adjustments and elaborations of this BEMP should be checked with a biodiversity expert (Marion Hammerl) who was present at the kick-off meeting of the TWG, but could not make it this time.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.10. Use of renewable energy

There was consensus among TWG members concerning the feasibility of the concept of this BEMP. However, it was noted that direct consumption of own production is not allowed in all EU Member States. This needs to be reflected in the applicability section.

Regarding the EPI 'Share of electricity from renewable sources (RES-E) in the electricity mix of the company', a value of 100% was proposed as BoE. A TWG member whose company has recently invested in RES-E considered this benchmark as achievable. In case companies installed CHP (combined production of heat and power) in the recent past, it is assumed that the BoE can be met by switching the feedstock for the CHP plant from fossil to renewable sources.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

4.11. Optimised waste management within manufacturing facilities

This BEMP was proposed as an additional BEMP to be developed for the manufacturing chapter during the TWG kick-off meeting.

The discussion came to the conclusion that it needs to be developed in more detail. Production scrap, as a relevant waste stream, was recommended by TWG members to be part of the scope of this BEMP. This is also applicable to the EPI that should focus on results rather than only on planning (e.g. landfill diversion rate, recycling rate). Waste generation per unit of product (being an EMAS core indicator) may be mentioned as well. TWG members from companies are asked to provide data in this respect.

Also the approach of industrial symbiosis was considered to be an interesting aspect. Companies should learn from opportunities of using waste streams in local cycles for resources.

Furthermore, the differences with the BEMP on process chemical recycling (see section 4.5) need to be clarified.

Finally, JRC asked the **TWG members** to indicate if they would like to be included in the discussion on benchmark setting for this BEMP.

5. BEMPs for supply chain management

5.1. Assessment tools for cost-effective and environmentally sound substitution of hazardous substances

There was a general agreement on the principle of the BEMP. A question was raised by some participants about the reasons for leaving out the two BEMPs on substituting phthalates, BFR and PVC from the Background Report. It was mentioned that there are front runner companies already implementing the substitution of the above mentioned substances. Some participants recommended using the previous BEMPs on the substitution of phthalates, BFR and PVC to extract few case study examples to be included in this BEMP.

It was emphasized that SMEs do not have the bargaining power to ask suppliers for Full Material Declarations (FMD); however, Supplier Declaration of Conformity complemented by laboratory testing was found to be a feasible approach. On the other hand, it was also mentioned that FMD could also be an efficient approach considering an ever-increasing list of restricted substances.

Some participants proposed to broaden the list of proposed tools and promote standards (e.g. IEC) that are already established at international level. It was emphasized that Green Screen, for instance, is a commercial product. It was clarified that a large number of tools are presented in the background report and that three tools are more specifically mentioned because of their high reliability compared to the others. JRC explained that the best practice report will contain references to different tools and standards, but in the official EMAS Sectoral Reference Document no proprietary tool will be mentioned. It was explained that the BEMP creates a methodological framework and rather describes the process of substitution. The BEMP is a general approach and is designed to integrate the use of existing standards.

The proposed EPI were generally agreed upon. In terms of BoE, it was discussed to check its feasibility. One proposal was made in terms of not covering all suppliers but rather the most important ones.

5.2. Disclose and set targets for supply chain GHG emissions

There was a general agreement on this BEMP. However, it was mentioned that it is not easy collecting data from the suppliers. Also, in this case, it was suggested to concentrate on the most important suppliers (e.g. in terms of expenditure). Therefore, the applicability section has to be strengthened, also including information on datasets and methodologies.

It was recommended to reference the Product Environmental Footprint (PEF) process.

One company mentioned that it had given up with collecting data on scope 3 emissions due to high effort required and risks that might emerge if comparison with competitors takes place. It was clarified that existing standards have strict requirements when comparative analysis for the purpose of public communication takes place. Hence, the risk perception is not substantiated.

The BoE were considered as sound and feasible by TWG members.

5.3. Conducting Life Cycle Assessment (LCA) and improving lifecycle impacts

There was a general agreement on this BEMP.

A participant invited to consider the ETV (environmental technology verification) approach as a potential additional element of this BEMP.

It was emphasized that implementing a LCA-thinking and applying LCA for major decisions, such as innovations, new products, etc. is more important than the number of LCAs conducted.

Concerning EPI the discussion among TWG members concluded in the following proposals:

- ‘LCA is included in the environmental strategy and used when conducting major decisions (Y/N)’;
- % of product range for which LCA improvement targets have been met.

As corresponding BoE, companies 'integrate LCA in product design processes' and safeguard that 'LCA is used whenever a new product is designed and/or substantial changes are made to a product'.

5.4. Increasing the content of recycled plastics in EEE

It was agreed to revise this BEMP in terms of expanding its scope from closed loop recycling towards including secondary plastics from other sectors.

In the background report, the case study example of rPET and rPP also includes waste streams from other sectors. However, the ink cartridges example may go against the waste hierarchy, i.e. putting re-use before recycling. Therefore, it would be better to have other examples, than ink cartridges, made of recycled plastics.

It was emphasized that it is important to distinguish between resins and applications and consider the specific characteristics of individual resins and applications.

One participant mentioned that the BEMP is very important from the perspective of recyclers because it fosters the demand of recycled plastics; however, issues such as presence of BFRs in plastics represent a major challenge.

Another participant stated that the availability of recycled plastic is often an issue: suppliers are generally in far-east Asia and if the demand of a certain recycled material is not high enough, it gets phased-out in a short-time.

The appropriate EPI agreed by the TWG is '% recycled plastic used in the manufacture of EEE out of total plastics use'.

Stakeholders mentioned a few good practice examples of using recycled plastics, such as in a green line for vacuum cleaners (Julia) and using plastics from recycled window frames by EEE manufacturing companies (Emmanuel). **Emmanuel** agreed to send information on this.

Eventually, a separate BEMP for the marketing/ communication aspect for recycled plastic could be developed (differentiating B2B and B2C segments).

6. BEMPs for End of life Electrical and Electronic Equipment

6.1. Design for repair, refurbishment, reuse and recycling

This is a newly developed BEMP that includes some elements from the previously proposed BEMP on 'End-of-Life removability of rechargeable batteries'. The scope has been considerably broadened, and in particular design for repair and refurbishment have been incorporated. JRC stressed that this BEMP is targeting EEE manufacturers and not recyclers.

A TWG member raised concerns about potential inconsistency of policies: product design is taken care of by the Ecodesign Directive and should not be addressed by EMAS. JRC explained that the Ecodesign Directive sets criteria at the product level to be met by all products on the market; this BEMP aims at describing the approach/process that frontrunner manufacturers implement to ensure they design products which are easy to repair, refurbish, reuse and recycle.

In order to provide more flexibility to the designers, this BEMP should be structured according to the fate of the product and explain how companies take into account this approach. However, there will be no specific requirement on the product level; instead, strategic guidance on the process of product development is considered to be much more helpful and relevant.

A TWG member highlighted that there is a major trade-off between product durability and energy efficiency that also needs to be considered by this BEMP.

TWG members suggested to present illustrative and inspirational case studies from EEE companies (e.g. on modularity). These could fit in the operational data section.

EPI and BoE need to be redeveloped according to the new concept of this BEMP.

6.2. Integrated Product Service Offering (IPSO) with effective collection, reuse and recycling

There was general agreement among TWG members on the principle of the BEMP.

JRC invited the TWG members to provide more examples on the B2C dimension, as was recommended at the kick-off meeting.

According to the experience of a TWG member, also many different approaches exist in B2B real life, which are not adequately reflected in the current version of the BEMP.

It was also suggested to explain better the distinction with the following BEMP (see section 6.3).

Concerning EPI, an indicator on the IPSO model as share of total turnover should be considered. Alternatively, the growth of the business segment could be used as a metric.

6.3. High quality refurbishment of used products

There was agreement on the principle of the BEMP. However, a TWG member pointed out that in France there are companies that have their core business on this approach.

As for the previous BEMP, illustrative and inspirational case studies are considered to be important. The discussion among TWG members came to the conclusion that mentioning the re-use of spare parts ('part harvesting') would be reasonable; JRC will contact **Riccardo** and **Sylvie** in this respect.

A revision of the 2nd indicator ('Sales of refurbished products within a product group in relation to the sales, including new equipment') might be needed. The 2nd BoE ('market share of refurbished products is above 5% of the total sales in a product segment') is not considered to be representative; TWG members recommend to investigate the possibility of proposing a new one.

6.4. Improved sorting solutions for polymers from WEEE

This BEMP is based on the previously proposed BEMP 'Innovative sorting solutions for black plastics from WEEE'; the original scope was broadened in order to include other plastics waste streams and sorting techniques.

The discussion among TWG members came to the conclusion that the techniques described in this BEMP are not applicable for most WEEE recyclers, but rather for very few specialised companies. For them, however, this technique is already mainstream practice.

Based on these findings, JRC will contact relevant specialised companies for further enquiries. Depending on the outcome of this investigation, JRC might consider removing this BEMP.

6.5. Improved transport of WEEE

The discussion of this new BEMP came to the conclusion that transport of WEEE is going to be covered by standard CENELEC 50625 (EC mandate). Also, TWG pointed out that WEEE must be transported intact according to regulation; this aspect is also relevant for worker safety.

As a consequence, JRC will consider refocusing or removing this BEMP. If it is removed, a TWG member proposed to use elements of this BEMP as an instrument in the refurbishment BEMP (section 6.3).

6.6. Summary and final overview

During wrap-up of the meeting JRC asked for input concerning areas that are suitable as BEMPs for recyclers.

Winifred proposed reverse logistics and will send some information on this topic.

Federico proposed the recovery of critical raw materials enabled by recycling chain; this could be a BEMP for WEEE recyclers by including criteria for the selection of end processors. However, other TWG members stated that WEEE recyclers already chose those end processors who pay the most, because they can recover the most.

Annex 1: Meeting agenda

FINAL MEETING OF THE TECHNICAL WORKING GROUP FOR THE EMAS SECTORAL REFERENCE DOCUMENT ON BEST ENVIRONMENTAL MANAGEMENT PRACTICES FOR THE ELECTRICAL AND ELECTRONIC EQUIPMENT MANUFACTURING SECTOR

BRUSSELS, 09-10 FEBRUARY 2016

AGENDA – DAY 1

Tuesday 09 February 2016 – Venue: Albert Borschette Conference Centre, Rue Froissart 36, Brussels		
Arrival and registration of participants		09:15 – 10:00
Opening and welcome		10:00 – 10:15
Introduction of experts		10:15 - 10:45
Adoption of the minutes of the kick-off meeting		10:45 - 11:00
Background and purpose of the meeting		11:00 - 11:15
Sectoral Reference Documents and Best Environmental Management Practices		11:15 - 11:45
Introduction to the concepts of Environmental Performance Indicator and Benchmark of Excellence		11:45 - 12:30
Scope and structure of the EMAS Sectoral Reference Document for the Electrical and Electronic Equipment manufacturing sector – A brief reminder		12:30 – 12:45
Lunch break		12:45 - 14:00
Environmental performance indicators and benchmarks of excellence for manufacturing processes and operations (first part)		14:00 - 16:00
Coffee break		16:00 - 16:30
Environmental performance indicators and benchmarks of excellence for manufacturing processes and operations (second part)		16:30 - 17:45
Wrap-up and close of the day		17:45 - 18:15

AGENDA – DAY 2

Wednesday 10 February 2016 – Venue: Albert Borschette Conference Centre, Rue Froissart 36, Brussels		
Opening of the day		09:00 - 09:15
Environmental performance indicators and benchmarks of excellence for supply chain management (first part)		09:15 - 11:00
Coffee Break		11:00 - 11:30
Environmental performance indicators and benchmarks of excellence for supply chain management (second part)		11:30 - 12:30
Lunch break		12:30 – 14:00
Environmental performance indicators and benchmarks of excellence for electrical and electronic equipment end-of-life		14:00 – 16:15
Conclusions		16:15 - 16:45
Wrap-up and close of workshop		16:45 - 17:00

Annex 2: List of participants

Name	Last name	Organisation	Country
Charisios	ACHILLAS	Aristotle University Thessaloniki	Greece
Ioannis	ANTONOPOULOS	Joint Research Centre, European Commission	EU
Maria	BANTI	DG ENV, European Commission	EU
Bernd	KAPPENBERG	CEFIC - The European Chemical Industry Council	Belgium
Jenny	BUCK	Air Compressors and Tools Ltd	United Kingdom
Paolo	CANFORA	Joint Research Centre, European Commission	EU
Riccardo	CORRIDORI	COCIR - European coordination committee of the radiological, electromedical and healthcare IT industry	Belgium
Maria Chiara	DETRAGIACHE	ORGALIME - European Engineering Industries Association	Belgium
Sylvie	FEINDT	Digital Europe	Belgium
Pierre	GAUDILLAT	Joint Research Centre, European Commission	EU
Patroklos	GEORGIADIS	Aristotle University of Thessaloniki	Greece
Olivier	HEBERT	Fairphone B.V.	Netherlands
Silke	HERMANNS	Globalfoundries	Germany
Winifred	IJOMAH	University of Strathclyde	United Kingdom
Lars	KOCH	Sony	Belgium
Maria	LOPEZ PARRON	Fairphone B.V.	Netherlands
Federico	MAGALINI	United Nations University - Institute for the Advanced Study of Sustainability	Germany
Martin	MÖLLER	Oeko-Institut	Germany
Bernd	NASS	Clariant Produkte (Deutschland) GmbH	Germany
Thomas	PAPAGEORGIOU	Anamet SA	Greece
Sebastien	PAQUOT	DG ENV, European Commission	EU
Emmanuel	PETIT	Legrand SA	France
Stephane	PEYS	Bigarren Bizi	France
Michael	PITTROFF	Solvay	Belgium
Siddharth	PRAKASH	Oeko-Institut e.V.	Germany
Philippe	SALEMIS	EERA - European Electronics Recyclers Association	Netherlands
Mihai	SCUMPIERU	Mitsubishi Electric Europe B.V.	Belgium
Arjen	SEVENSTER	European Council of Vinyl Manufacturers	Belgium
Eric	SITTERS	EFRA - European Flame Retardants Association	Netherlands
Ioana	SMARANDACHE	PNEUROP - European Association of manufacturers of compressors, vacuum pumps, pneumatic tools and allied equipment	Belgium
Emilie	STUMPF	CECED - European Committee of Domestic Equipment Manufacturers	Belgium
Jan	TYTGAT	Umicore Precious Metals Refining	Belgium
Julia	WOLF	Dr. Brüning Engineering	Germany

Annex 3: Presentations

Purpose and goals of the meeting

Final meeting of the
Technical Working Group on
Best Environmental Management Practice for the
Electrical and Electronic Equipment Manufacturing Sector

Brussels, 9-10 February 2016

jrc-ipts-emas@ec.europa.eu

Sustainable Production and Consumption Unit

Institute for Prospective Technological Studies (IPTS)

Joint Research Centre (JRC)

European Commission

EMAS

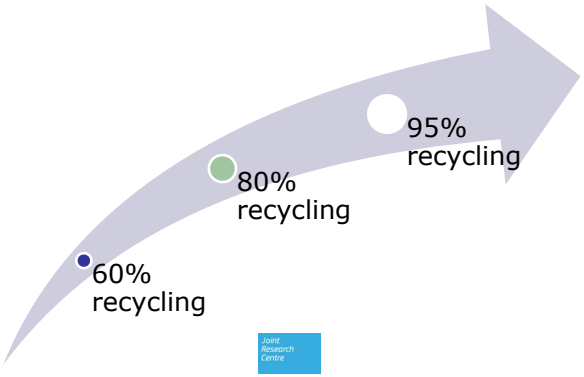
EMAS Performance, Credibility, Transparency

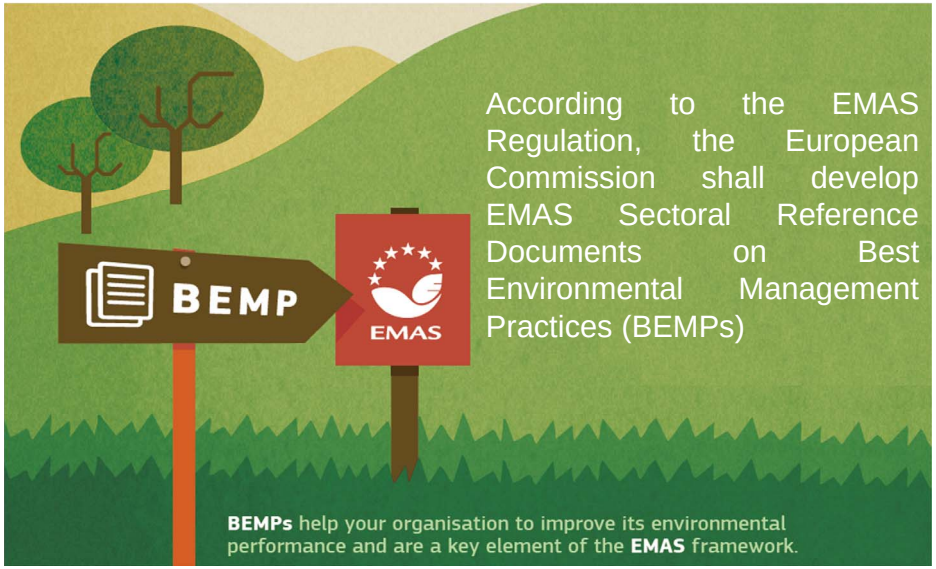
What is EMAS? EU Eco-Management and Audit Scheme

- √ An Environmental Management System?
- √ An EU Regulation?
- √ An environmental performance reporting tool?

EMAS is a commitment to…

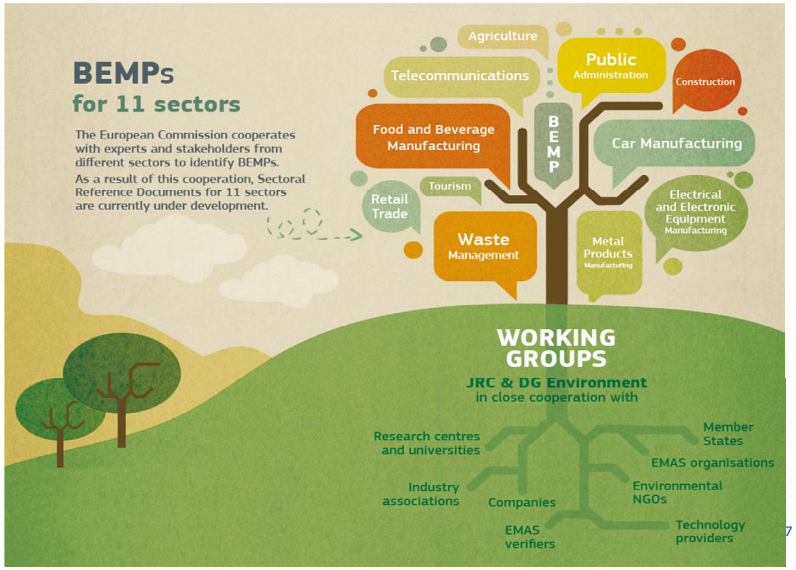
… in environmental performance



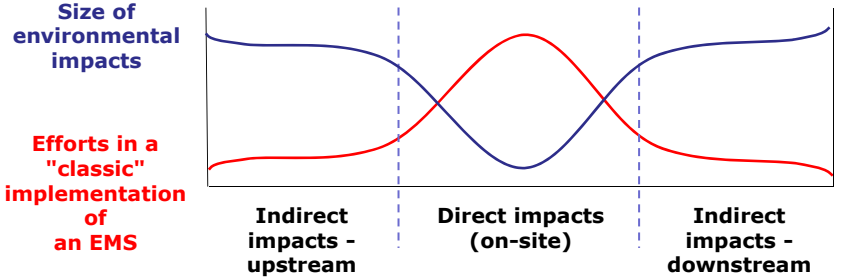


The Sectoral Reference Documents on Best Environmental Management Practice

- Legal basis: EMAS Regulation (EC) No 1221/2009
- Voluntary nature
  - EMAS is a voluntary tool
  - Implementation of best practices is voluntary
- Not only for EMAS registered organisations but for all actors within the sectors covered which intend to improve their environmental performance



Need to focus on the most relevant environmental impacts

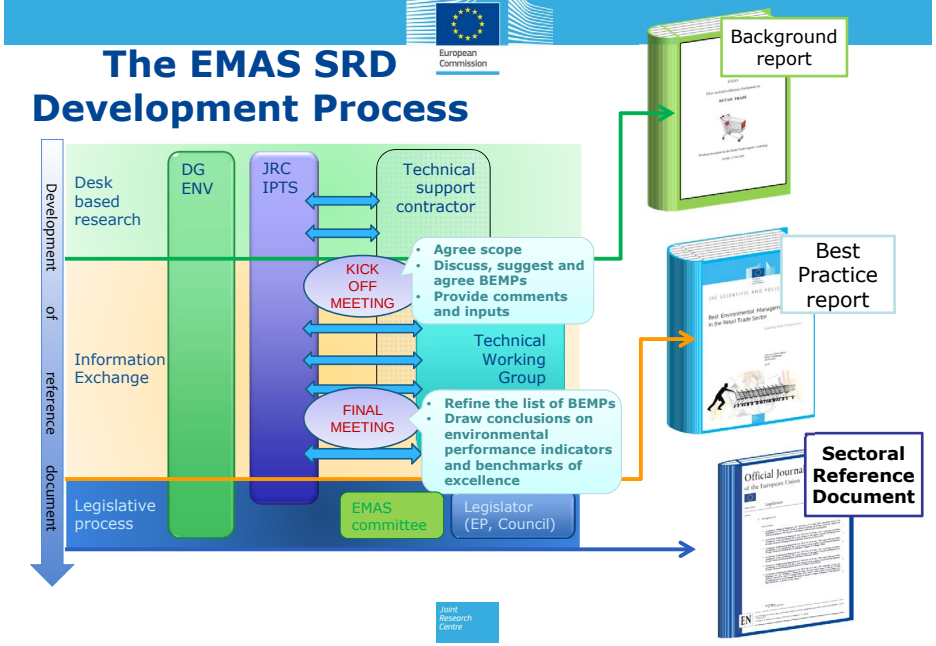


Methodology for developing the SRDs

Each SRD is developed according to the following logical steps:

- Define the scope of the document and identify relevant actors;
- Target processes associated with greatest environmental impact;
- Identify frontrunner actors for particular processes;
- Describe best environmental practices with reference to frontrunner application;
- Identify relevant environmental performance indicators for each best practice;
- Derive “benchmarks of excellence” from front-runner performance;
- Clearly state applicability.

The EMAS SRD Development Process



The timeline

Purpose of this final meeting

- Refine the list and concept of all best practices
- Draw conclusions on environmental performance indicators and benchmarks of excellence
- Identify gaps and information needs
- Get further feedbacks and inputs to finalise the work

Thank you!

Paolo Canfora
Marco Dri
Ioannis Sofoklis Antonopoulos
Pierre Gaudillat

European Commission
Joint Research Centre
Institute for Prospective Technological Studies
Sustainable Production and Consumption Unit

Edificio EXPO
C/ Inca Garcilaso, 3; E-41092 Seville

Email: jrc-ipts-emas@ec.europa.eu
http://susproc.jrc.ec.europa.eu/activities/emas/index.html

Sectoral reference documents and best environmental management practices

Final meeting of the
Technical Working Group on
Best Environmental Management Practice for the
Electrical and Electronic Equipment Manufacturing Sector

Brussels, 9-10 February 2016

jrc-ipts-emas@ec.europa.eu

Sustainable Production and Consumption Unit
Institute for Prospective Technological Studies (IPTS)
Joint Research Centre (JRC)
European Commission

Main elements of the sectoral reference documents

The sectoral reference documents comprise 3 main elements:

- Best environmental management practices (BEMPs)

  Managing and minimising waste in offices




- Environmental performance indicators

  Waste generation in office buildings per employee and year (kg/employee/yr)
- Benchmarks of excellence

  Total waste generation in office buildings is lower than 200 kg/employee/yr

An example from:

Best Environmental Management Practices (BEMPs)

What is BEMP:

- those techniques, measures or actions that allow organisations of a given sector to **minimise their impact on the environment**
- **direct** and **indirect** aspects
- **technical/technological** as well as **management /organisational** type
- **fully implemented** by best performers
- technically **feasible** and economically **viable**

Best Environmental Management Practices (BEMPs)

BEMP is what goes well beyond common practice

but is already fully implemented

and widely applicable

What is not BEMP:

- Obsolete techniques
- Common practice
- Good practice
- Emerging techniques
  - are available and innovative
  - not yet proved their economic feasibility
  - not yet implemented at full scale

Best Environmental Management Practices (BEMPs)

Description of BEMPs (requires detailed technical information):

- Description
- Achieved environmental benefit
- Appropriate environmental indicator
- Cross-media effects
- Operational data
- Applicability
- Economics
- Driving force for implementation
- Reference organisations
- Reference literature

Structure similar to Best Available Technique Reference Documents (BREFs) according to Industrial Emission Directive

Environmental Performance Indicators and Benchmarks of Excellence

- **Environmental performance indicators**
  - "specific expression that allows measurement of an organisation's environmental performance" (EMAS Regulation)

already in use

environmentally meaningful

can be a proxy

- **Benchmarks of excellence**
  - exemplary environmental performance

very ambitious

achieved by frontrunners

not a target but a measure of what is possible

How to identify BEMPs

The frontrunner approach

Two final outputs for each sector

Best Practice report

Sectoral Reference Document

The documents produced so far…

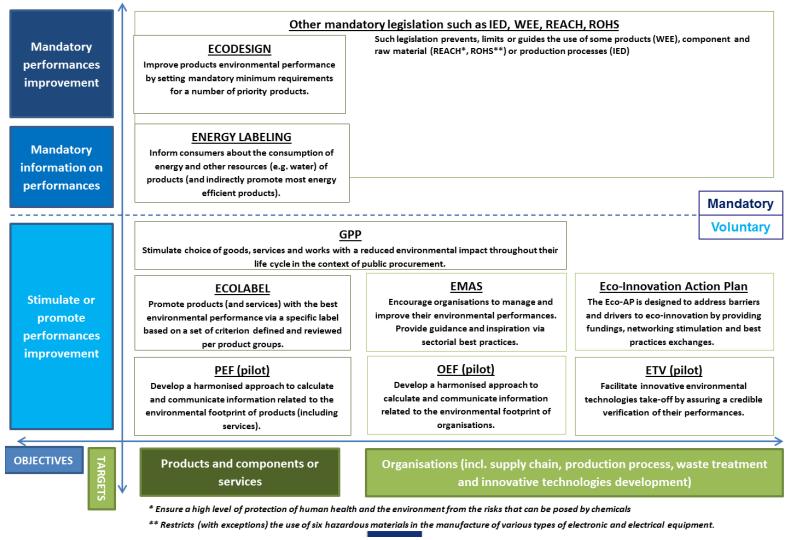
Best practice reports

Sectoral Reference Documents

Use of the EMAS SRDs

- **EMAS registered organisations**: According to the EMAS regulation "Where sectoral reference documents […] are available for the specific sector, the assessment of the organisation's environmental performance shall take into account the relevant document" (Regulation EC 1221/2009 Article 4.1(d)).
  - Information on (likely) most relevant environmental aspects.
  - Inspiration on what measures can be implemented next for continuous environmental performance improvement.
  - Recommended environmental performance indicators.
- Value beyond EMAS: Reference documents for all organisations in the sectors covered which intend to improve their environmental performance

Interaction between EMAS and other policy instruments



Thank you!

Paolo Canfora
Marco Dri
Ioannis Antonopoulos
Pierre Gaudillat

European Commission
Joint Research Centre
Institute for Prospective Technological Studies
Sustainable Production and Consumption Unit

Edificio EXPO
C/ Inca Garcilaso, 3; E-41092 Seville

Email: jrc-ipts-emas@ec.europa.eu
http://susproc.jrc.ec.europa.eu/activities/emas

Environmental performance indicators and benchmarks of excellence

Final meeting of the
Technical Working Group on
Best Environmental Management Practice for the
Electrical and Electronic Equipment Manufacturing Sector

Brussels, 9-10 February 2016

jrc-ipts-emas@ec.europa.eu

Sustainable Production and Consumption Unit
Institute for Prospective Technological Studies (IPTS)
Joint Research Centre (JRC)
European Commission

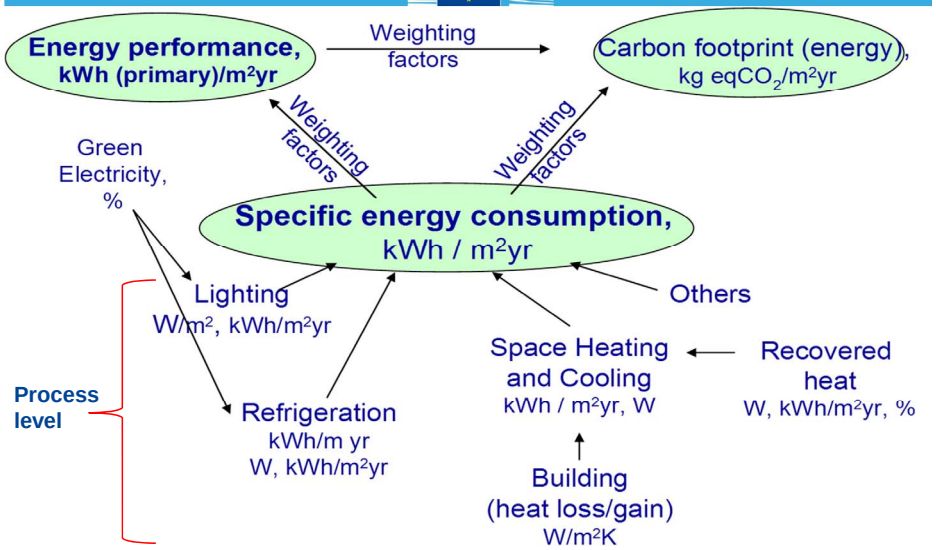
Environmental performance and benchmarks of excellence

- **Environmental performance indicators:** "specific expression that allows **measurement** of an organisation's **environmental performance**" (EMAS Regulation)
  - Core indicators
  - Specific indicators
  - (Alternative indicators)

  → (i) Energy efficiency
  (ii) Material efficiency
  (iii) Water
  (iv) Waste
  (v) Biodiversity and
  (vi) Emissions.
- **Benchmarks of excellence:** level of **environmental performance** achieved by the **best performers** (front-runners)

Environmental performance and benchmarks of excellence – sector level

- Sector-specific environmental indicators and 'benchmarks of excellence' are considered **an outcome of the whole process**
- Final selection of the indicators is made in accordance with **available data and practical/technical information** from organisations, stakeholders, literature, etc.
- Indicators should measure the environmental performance of the organisation - but as focussed on the **'process'** or **'activity' level**



Selection of environmental indicators

- Sector-specific environmental indicators are defined in relation to a specific **BEMP**
- Indicators must be **actually used** within the industry and/or they must be **calculated easily**
- Indicators must be as **specific** as possible in order to allow the **comparison** across organisations, across sites of an organisation and against given **benchmarks**

From indicators to benchmarks

"Benchmark" levels can be defined based on many approaches e.g.:

- ~~The best~~
- Top 10 or Top 10%
- ~~Current average in sector~~
- ~~Potential average in sector using "best practice"~~
- ..... etc.

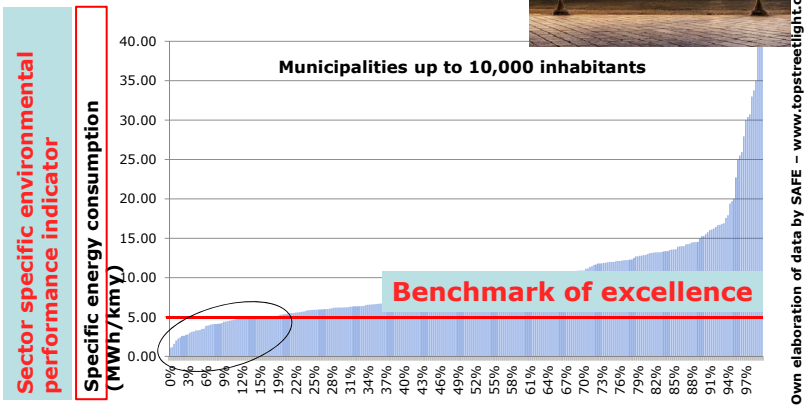
- But then what do we mean by "best practice"?
  - Achievable by ~~a few / many~~ / most / all ? → **Already achieved by a few**
  - Taking account of sector-specific economics ? → **Applicability and special circumstances are also taken into account**

Identifying benchmarks of excellence (1)

- **Frequency distributions** of a quantified *environmental performance indicator* can be used to derive the benchmark of excellence once the indicators have been identified.
- The benchmarks of excellence correspond to the performance levels achieved by **frontrunners**.
- They correspond to the performance of best performers identified e.g. as the **top 10-20%** in the industry

Quantitative benchmark: an example

Public lighting



Identifying benchmarks of excellence (2)

- Benchmarks of excellence can also be:
  - **a yes or no criterion,** e.g.: natural refrigerants are used in all refrigeration systems in all sites (from the food and beverage manufacturing sector – BEMP on improved freezing and refrigeration)
  - **a percentage of implementation of a certain BEMP**, e.g.: ≥ 50% of the animal population consist of locally adapted breeds (hybrids) (from the agriculture sector – BEMP on the use of locally adapted breeds in the farm)

Use of benchmarks

- Provide information to users of **what is potentially achievable** under certain defined circumstances.
- Possibility to **form an opinion** whether an organisation/process is performing well.
- They should be **meaningful** in terms of relevance to **environmental impact**.

Lessons learnt

Environmental performance indicators and benchmarks

- In many cases, clear conclusions on environmental indicators and also on benchmarks of excellence could be drawn.
- Quantitative distribution not always available but other effective methods for benchmarking can be used.
- A key role of the technical working group is to validate the findings, and to draw conclusions on environmental performance indicators and benchmarks of excellence

Thank you!

Paolo Canfora
Marco Dri
Ioannis Sofoklis Antonopoulos
Pierre Gaudillat

European Commission
Joint Research Centre
Institute for Prospective Technological Studies
Sustainable Production and Consumption Unit

Edificio EXPO
C/ Inca Garcilaso, 3; E-41092 Seville

Email: jrc-ipts-emas@ec.europa.eu
http://susproc.jrc.ec.europa.eu/activities/emas/index.html

Scope and structure of the document – A brief reminder

Scope of the document (reminder)

Target group of the document: the BEMPs are aimed either at EEE manufacturers or at companies dealing with the end-of-life treatment / recycling of waste electrical and electronic equipment (WEEE).

The scope built on a life-cycle thinking approach ("from cradle to grave").

The BEMPs are grouped:

- On-site perspective (within the "gate"): manufacturing;
- Upstream perspective (towards "cradle"): supply chain management;
- Downstream perspective ("from gate to grave"): EEE end-of-life.

List of BEMPs (reminder)

Manufacturing of EEE (today 9th February)

No	Title of BEMPs		Resource efficiency	Water	Waste	Emissions to air	Energy & climate change	Biodiversity	Hazardous substances
	MANUFACTURING								
1	Energy-efficient cleanroom technology	Target group: EEE manufacturers	x				x		
2	Energy-efficient cooling technology		x				x		
3	Energy-efficient soldering		x			x	x		
4	Substitution and optimised use of VOC-based solvents		x			x			x
5	On-site recycling of metals in process chemicals		x		x	x			x
6	Water savings and recovery in cascade rinsing systems			x	x				
7	Minimising perfluorocompounds emissions					x	x		x
8	Rational and efficient use of compressed air		x				x		
9	Protecting and enhancing biodiversity							x	
10	Use of renewable energy		x				x		
11	Optimised waste management within manufacturing facilities		x		x				New BEMP

List of BEMPs (reminder)

Supply chain management in the EEE sector (tomorrow 10th February)

No	Title of BEMPs		Resource efficiency	Water	Waste	Emissions to air, soil and water	Energy & climate change	Biodiversity	Hazardous substances
	SUPPLY CHAIN MANAGEMENT								
12	Assessment tools for cost-effective and environmentally sound substitution of hazardous substances	Target group: EEE manufacturers							x
13	Disclose and set targets for supply chain GHG emissions						x		
14	Conducting Life Cycle Assessment (LCA) and improving lifecycle impacts		x	x	x	x	x		
15	Increasing the content of recycled plastics in EEE		x				x		

List of BEMPs (reminder)

End-of-life of EEE (tomorrow 10th February)

No	Title of BEMPs	Target group	Resource efficiency	Water	Waste	Emissions to air, soil and water	Energy & climate change	Biodiversity	Hazardous substances
	END OF LIFE EEE								
16	Design for repair, refurbishment, reuse and recycling	EEE manufacturers	x		x		New BEMP		x
17	Integrated product service offering (IPSO) with effective collection, repair and recycling		x		x		x		
18	High quality refurbishment of used products		x		x		x		
19	Improved sorting solutions for polymers from WEEE	Recyclers	x		x				
20	Improved transport of WEEE		x		x			New BEMP	

Joint Research Centre

Manufacturing of Electrical and Electronic Equipment Manufacturing

Identification of BEMPs for manufacturing processes and operations

Overview of the developed BEMPs

No	Title of BEMPs		Resource efficiency	Water	Waste	Emissions to air, soil and water	Energy & climate change	Biodiversity	Hazardous substances
	MANUFACTURING								
1	Energy-efficient cleanroom technology	Target group: EEE manufacturers	X				X		
2	Energy-efficient cooling technology		X				X		
3	Energy-efficient soldering		X			X	X		
4	Substitution and optimised use of VOC-based solvents		X			X			X
5	On-site recycling of metals in process chemicals		X		X	X			X
6	Water savings and recovery in cascade rinsing systems			X	X				
7	Minimising perfluorocompounds emissions					X	X		X
8	Rational and efficient use of compressed air		X				X		
9	Protecting and enhancing biodiversity							X	
10	Use of renewable energy		X				X		
11	Optimised waste management within manufacturing facilities		X		X		New BEMP		

1. Energy efficient cleanroom technology

State of play

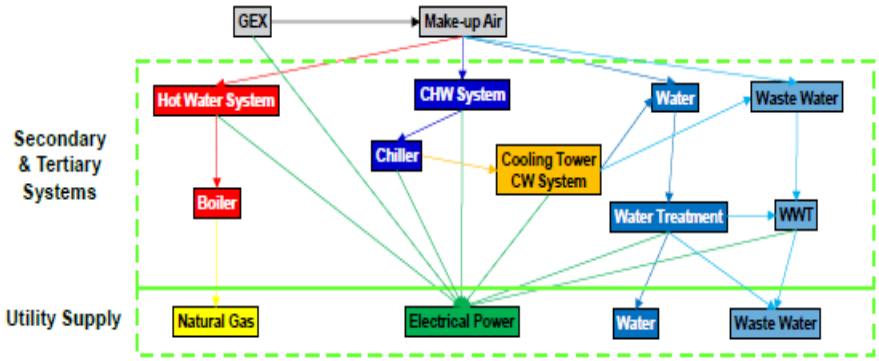
- No major changes compared to the background report
- Content updated according to the comments received

Description

- **BEMP is to minimise the energy consumption of cleanrooms**
- **Ultra-clean production conditions** are essential for the manufacture of **IC** and **PCB**
- The following measures should be taken into account when an energy efficient cleanroom technology room is designed:
  1. Optimised sizing/design of cleanrooms
  2. Reduction of the heat load and recovery of the waste heat when feasible
  3. Use of highly efficient components and equipment
  4. Implementation of a detailed energy modelling analysis in the facility

Remark: These measures can be applied either separately or jointly

Integrated design of an energy cleanroom technology



Case study: M+W group

Achieved environmental benefits

- Lower electricity consumption, thus lower CO_2 emissions

Applicability

- The BEMP is applicable to all EEE companies operating cleanrooms that are planning a new cleanroom or a major retrofit.

Economics

- Electricity costs account for 65-75% of the total cleanroom operating costs
- Pay-back times are highly varying from case to case

Appropriate environmental performance indicators

Metrics	Description
kWh/cm²	Energy consumption of processed silicon wafers
kWh/m²	Energy consumption of processed printed circuit boards
number/ hour (ARC)	A measurement of how many times the air within a defined cleanroom space needs to be replaced in order to meet the cleanliness requirements of the room

Proposals for benchmark of excellence

- Air change rate < 200/hour

2. Energy efficient cooling

State of play

- No major changes compared to the background report
- Content updated according to the comments received

Description

- **BEMP is to remove the process heat that is accumulated in the production processes and production halls by providing the right amount of cooling energy**
- The continuous use of fine structures makes the cooling systems very important e.g. production of integrated circuits (IC)
- **4 major approaches** for sustainable cooling technology
  1. Assessment and optimisation of the **required room temperatures**
  2. Use of **cooling cascades** (e.g. 6/12 ºC and 12/18 ºC flow/return system)
  3. Use of **free cooling**
  4. Use of **absorption cooling technology**
- **Best results are achieved through an integrated approach implementing all or most of these measures**

Achieved environmental benefits

- Lower electricity demand

Applicability

- Energy efficient cooling systems are generally applicable to all the EEE manufacturing companies

Economics

- Pay-back times are highly varying from case to case

Appropriate environmental performance indicators

Metrics	Description
$kWh_{electricity}$ / $kWh_{cooling\ energy}$	Electricity use per cooling energy generated

Proposals for benchmark of excellence

- N/A

3. Energy efficient soldering

State of play

- Content updated according to the comments received

Description

- **BEMP is to reduce the energy consumption by implementing reflow soldering processes on PCBs with an array of optimisation measures**
- When installing new reflow soldering equipment, the following measures can be implemented:
  - improved power management system;
  - use of direct-current fan motors;
  - use of a cooling unit enabling waste heat recovery;
  - optimised use of liquid nitrogen.

Achieved environmental benefits

- Lower electricity demand
- Lower nitrogen demand

Applicability

- Maximization of throughput as well as on retrofit insulation are applicable for existing equipment
- Improved power management systems and optimised use of nitrogen can only be implemented when installing a new soldering line
- Measures aiming at avoiding the use of nitrogen are applicable both for existing and newly installed equipment

Economics

- Lower operating costs from reduced energy use (20-25%)
- Pay-back times are highly varying from case to case

Appropriate environmental performance indicators

Metrics	Description
kWh (of electricity) / m² (of PCB)	Total energy demand (in terms of electricity) referring to the surface of the treated processed printed circuit board (PCB). (N.B. Since there is a large variety of PCB as well as of electronic components on the assemblies, parameters such as the type of PCB (multilayer, double-sided, etc.) as well as the amount of components and the used solder paste need to be provided as additional information for the indicator described above)

Proposals for benchmark of excellence

- Electricity consumption < 1.0 kWh/m^2;
- Nitrogen consumption < 2.2 m^3/m^2

4. Substitution and optimised use of VOC-based solvents

State of play

- Content updated according to the comments received

Description

- **BEMP is to substitute and optimise the use of VOC based solvents by semi-aqueous chemicals or to apply on-site solvent recovery**
- Two major approaches for the sustainable use of VOC-based solvents exist:
  1. **Substitution of VOC-based solvents** by semi-aqueous chemicals (replacement of HDA by dilute acid formulations of sulphuric acid (H_2SO_4), hydrogen peroxide (H_2O_2) and hydrofluoric acid (HF))
  2. On-site **solvent recovery** (both control of vapour emissions and manufacture of secondary solvents)

Achieved environmental benefits

- Substantial environmental savings:
  - Lower electricity demand and resource depletion

Applicability

- Substitution is broadly applicable.
- The solvent recovery is most applicable where:
  - the amount of solvents is large,
  - the value of the solvents is high, or
  - the solvents contain chlorine, bromine, fluorine or nitrogen;
  - but may not be feasible for semiconductor companies.

Economics

- Both substitution and solvent recovery save costs
  - savings highly depend on the specificities of every case.

Appropriate environmental performance indicators

Metrics	Description
Y/N	Substitution of solvents has been implemented
%	Solvent recovery rate (i.e. share of recovered solvent vs. total used amount of solvent)

Proposals for benchmark of excellence

- VOC-based solvents have been substituted by semi-aqueous chemistries
- Solvent recovery rate >75%

5. On-site recycling of metals in process chemicals

State of play

- No major changes compared to the background report
- Content updated according to the comments received, but looking for more examples on the recovery of precious metals

Description

- **BEMP is to recover copper and precious metals in process chemicals**
- The focus of this BEMP is on copper and precious metals recovery which is particularly significant for PCB manufacturing
- On technical grounds, the recovery of precious and transition metals is usually achieved from waste water by electrolysis (plating out on high surface area electrodes in metal recovery cells)

Achieved environmental benefits

- The on-site recycling of copper allows for an extended use of the etching agent: reductions of more than 95% have been reported.
- Lower water needs and waste generation.

Applicability

- A minimum amount of recycled copper per year is required: 60 t of recycled copper/year (otherwise the payback period is longer)
- There are minimum space requirements for the system: between 50 and 80 m², depending on the arrangement of the installation and the volume of the buffer tanks.

Economics

- Investment payback time: between 6 and 18 months

Appropriate environmental performance indicators

Metrics	Description
Y/N	Installation of a copper recycling system

Proposals for benchmark of excellence

- Copper recycling system has been installed
- For precious metals, would it be meaningful?
- Would a more generic benchmark of excellence to cover all the potential metal streams be more sound?

6. Water savings and recovery in cascade rinsing systems

State of play

- No major changes compared to the background report

Description

- **BEMP is to implement water saving measures by investing in multiple cascade rinsing systems and in retrofitting or optimising measures for existing plants**

- The state of the art is the multiple use of rinsing water:
  - i. in vertical installations
  - ii. in horizontal installations

Achieved environmental benefits

- Lower water needs

Applicability

- The BEMP is fully applicable to all EEE manufacturing companies
- For existing facilities, space might be a technical limitation/constraint

Economics

- Cost savings and payback periods highly depend on the local water and waste water tariffs

Appropriate environmental performance indicators

Metrics	Description
%	Percentage of cascade rinsing systems with at least four stages compared to the total number of necessary rinsing systems within PCB production

Proposals for benchmark of excellence

- > 50% rinsing facilities are equipped with a cascade rinsing system having at least four stages

7. Minimising perfluorocompounds emissions

State of play

- No major changes compared to the background report
- Content updated according to the comments received

Description

- BEMP is to reduce PFC emissions by minimising their use and implementing appropriate abatement techniques
- Five major approaches for minimising PFC emissions are implemented by frontrunner companies:
  1. *Process optimisation* (focused on CVD chamber cleaning)
  2. *Substitution* of PFC gases (e.g. replacement of C_2F_6 by C_3F_8, focused on CVD chamber cleaning)
  3. *Remote plasma cleaning* technology (NF_3 instead of C_2F_6 and CF_4)
  4. *Point-of-use abatement* during plasma etching (small plasma source)
  5. Installation of *end-of pipe purification techniques* for contaminated exhaust air (removal efficiency of up to 99%)

Achieved environmental benefits

- Climate change mitigation

Applicability

- Process optimization is broadly applicable, including in existing production facilities
- PFC substitution is not always technically feasible
- Remote plasma cleaning and point-of-use abatement are applicable during innovation or for new facilities

Economics

- Process optimisation is cost effective due to lower gas consumption and better throughput.
- All other measures have substantial costs.

Appropriate environmental performance indicators

Metrics	Description
kg $CO2_e/cm^2$	Normalised Emission Rate (NER), which corresponds to the global warming potential caused by the PFC emissions of a production site in relation to the surface of the produced wafers

Proposals for benchmark of excellence

- PFC emissions abatement < 0.22 kg CO_2eq/cm^2

8. Rational and efficient use of compressed air

State of play

- Content updated according to the comments received

Description

- **BEMP is to reduce energy consumption by mapping and assessing the use of compressed air and optimising the compressed air system:**

Mapping the use of compressed air and identification, if relevant, of inappropriate or inefficient use of compressed air.

Optimisation of the compressed air system:

1. Identifying and eliminating leaks using appropriate control technology;
2. Increasing the overall energy efficiency of the compressed air system;
3. Increasing the specific energy efficiency of major compressed air system components;
4. Implementing waste heat recovery.

Achieved environmental benefits

- Reductions in energy use up to 66% are reported

Applicability

- The measures can be applied by all companies that have a compressed air system.
- Waste heat: a continuous demand of process heat is necessary in order to realise the corresponding energy and cost savings.

Economics

- 59 firms detected potential energy and cost savings from improving their use of compressed air of, on average, 34%, with payback times between two and four years – data from German study (VDMA, 2005)

Appropriate environmental performance indicators

Metrics	Description
kWh/m³	kWh of electricity use per cubic meter of compressed air at the point of end-use at a stated pressure level

Proposals for benchmark of excellence

- Energy Performance Indicator <0.11 kWh/m³ for a compressed air system operation at a pressure of approx. 6.5 bars

9. Protecting and enhancing biodiversity

State of play

- Content updated according to the comments received

Description

- **BEMP is to put in place a biodiversity action plan to monitor and improve impacts on biodiversity in own operations and throughout the value chain**

- Examples of items from the checklist of actions to be included in the plan and implemented:
  - Company level (whole value chain)
    - Incorporate biodiversity protection efforts in procurement activities
  - Facility level (local)
    - Implement third party monitoring of biodiversity on and adjacent to sites
    - Involvement of staff
    - Implement phyto-remediation and bio-remediation technologies
    - Activities such as planning trees or reintroducing native species into a degraded natural environment

Achieved environmental benefits

- Numerous environmental benefits, from local air quality improvement to dispersion of seeds and pollination of crops and natural vegetation.

Applicability

- Indirect biodiversity action (targeting supply chain) are broadly applicable although in different ways.
- Direct on-site actions are always possible to some extent; some are more relevant for sites surrounded by natural areas.

Economics

- Implementation costs vary, but low-cost actions are often possible (e.g. employees volunteering).

Environmental performance indicators

Metrics	Description
Y/N	(Company strategy) Incorporation of the evaluation of the biodiversity protection efforts of suppliers within Green Procurement Guidelines.
%	(Company strategy) Percentage of purchases made from suppliers considered to have lower impacts on biodiversity
Number	(Facility perspective) Number of areas (out of the checklist provided in the BEMP) for which actions are included in the action plan and implemented

Proposals for benchmark of excellence

- X% of purchases made from suppliers considered to have lower impacts on biodiversity
- Actions were included in the action plan and implemented for all facilities for at least 3 areas and for 50% of all facilities for at least 5 areas out of those indicated in the checklist in the BEMP.

10. Use of renewable energy

State of play

- No major changes compared to the background report
- Content updated according to the comments received

Use of renewable energy (RES)

- **BEMP is to increase the use of renewable energy by following a strategic approach**
- Important elements to be considered:
  - Purchase of green electricity with additional environmental benefit
  - Own production of heat from RES
  - Own production of electricity from RES (RES-E)

Remarks:

1. Purchased green electricity needs appropriate certification
2. Own electricity/heat generation from RES will largely depend on locally available solutions e.g. solar photovoltaic, wind turbine, solar thermal, biomass/biogas or even geothermal.

Achieved environmental benefits

- Direct benefit in terms of GHG emissions

Applicability

- In general fully applicable to all EEE manufacturing companies:
  - Technical limitations may include: limited availability of suitable feedstock, sustainable sourced biomass, unavailability of roof space, etc.

Economics

- The decision to invest in renewables may be hindered by a recent investment made (e.g. a CHP unit).

Appropriate environmental performance indicators

Metrics	Description
The use of electricity from RES-E should be monitored by (taking into account the national electricity mix):	
% (RES-E)	**Share of electricity from renewable sources (RES-E) in electricity mix of the company**
CO_2-equivalents	**Greenhouse gas emissions of the company-specific electricity mix**
The use of heat from RES-E should be monitored by:	
% (RES)	**Share of heat from renewable sources (RES) in heat energy mix of the company**
CO_2-equivalents	**Greenhouse gas emissions of the company-specific heat energy mix**

Proposals for benchmark of excellence:

N/A

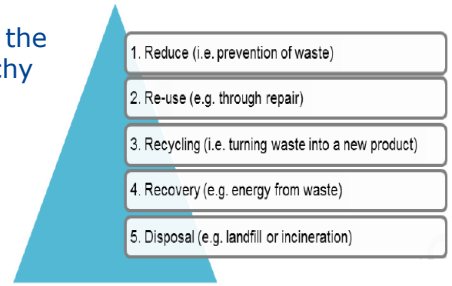
11. Optimised waste management within manufacturing facilities

State of play

- New BEMP

Description

- BEMP is to put in place waste management plans that prioritise the highest steps in the waste hierarchy and set targets for improvement.
- 2 main waste categories:
  - 'Household' type and other waste (including hazardous streams)
- 'Household' type waste should be segregated at source and sent for recycling whenever possible.
- Other waste needs specific handling and treatment; the effectiveness of service providers can be checked by internal and external audits.



The hierarchy of waste management options within manufacturing stage in EEE sector (EC 2008/98)

Achieved environmental benefits

- Improved resource efficiency
- Reduction of the amount of the disposed waste
- Reduced impacts from waste handling and treatment

Applicability

- In general fully applicable to all EEE manufacturing companies
  - Measure implemented should take into consideration the availability of local infrastructure and the local waste regulation.

Economics

- Economic figures are highly dependent on the specific activities/waste operations carried out.
- Savings arise from waste prevention, reuse and recycling activities.

Appropriate environmental performance indicators

Metrics	Description
Y/N	Implementation of waste management plans including targets for improvements
%	Number of sites with waste management plans in place

Proposals for benchmark of excellence:

N/A

Manufacturing of Electrical and Electronic Equipment Manufacturing

Identification of BEMPs for supply chain management operations

Overview of the developed BEMPs

No	Title of BEMPs		Resource efficiency	Water	Waste	Emissions to air, soil and water	Energy & climate change	Biodiversity	Hazardous substances
	SUPPLY CHAIN MANAGEMENT								
12	Assessment tools for cost-effective and environmentally sound substitution of hazardous substances	Target group: EEE manufacturers							x
13	Disclose and set targets for supply chain GHG emissions						x		
14	Conducting Life Cycle Assessment (LCA)		x	x	x	x	x		
15	Increasing the content of recycled plastics in EEE		x				x		

12. Assessment tools for cost-effective and environmentally sound substitution of hazardous substances

State of play

- No major changes compared to the background report

Description

- Difficult to collect reliable information on substances: few tools
  - Available assessment and substitution tools on the website: subsport.eu
  - 3 reliable tools: Green Screen™, Pollution Prevention options Analysis System (P2OASys) and Stockholm Convention Alternatives Guidance

➔ How to use them? Which steps are necessary?

- 1st step is clarification: whether the substance under discussion is a substance of very high concern, as listed on the REACH candidate list. For these substances, substitution has high priority.
- 2nd step: classification of the substance (actual data compared with the data from a database of hazardous substances).
- 3rd step: use of one of the three above mentioned tools.

Achieved environmental benefits

- Substitution tools allow the identification of effective substitutions and subsequent reduction of environmental impacts

Applicability

- This methodology is fully applicable to all companies although:
  - Green Screen™ is suitable to assess and compare individual chemicals, not products, processes or alternative technologies
  - P2OASys can be used to compare products, processes and technologies

Economics

- Green Screen™ (licensed profiler) costs can range from 850-1,500 USD per chemical – duration: 18-25 hours to do a full assessment

Appropriate environmental performance indicators

Metrics	Description
%	Major OEM suppliers (in terms of % supply chain expenditure) provide a full material declaration
%	Major OEM suppliers (in terms of % supply chain expenditure) issue a Supplier Declaration of Conformity for company specific list of restrictions, complemented by a certification (preferably third-party) based on laboratory testing
%	OEM publishes the information on its website and annual sustainability reports disclosing the percentage of suppliers (in terms of % supply chain expenditure) complying with the above mentioned requirements

Proposals for benchmarks of excellence

- Mandatory requirements for suppliers to provide a Full Material Declaration are in place.

13. Disclose and set targets for supply chain GHG emissions

State of play

- No major changes compared to the background report

Description

- The best management approach aims at reducing GHG emissions through:
  - Publicly disclosing significant supply chain emissions according to recognised standard(s)
  - Setting and meeting (absolute and relative) targets for their reduction
- Disclosed GHG emissions:
  - NOT to be used for comparisons between companies and products
  - rather as an internal tool in order to monitor and reduce GHG emissions at the company level

Achieved environmental benefits

- Disclosure itself does not lead to lower GHG emissions but in combination with ambitious GHG reduction targets result in significant GHG emission reduction

Applicability

- It is fully applicable to all companies – sector specific guidance is necessary

Economics

- Implementation will be dependent upon achievable payback times
  - Applied examples for ICT companies: ¾ of implemented reduction activities achieve payback times within 3 years

Appropriate environmental performance indicators

Metrics	Description
Y/N	Periodically published report according to recognised standards (e.g. annual report)
Y/N	Number and extent of Scope 3 emissions/emission categories covered
Y/N	Disclosure of absolute or relative GHG emission reduction targets in the periodically published (e.g. annual report)
Y/N	Absolute and/or relative emission reductions demonstrated based on same standard

Proposals for benchmarks of excellence:

1) Annually updated accounting for all Scope 3 GHG emissions
2) Third-party verification and disclosure of the full corporate GHG inventory
3) Directly working together with key suppliers on reducing GHG emissions and other environmental impacts

14. Conducting Life Cycle Assessment (LCA) and improving lifecycle impacts

State of play

- No major changes compared to the background report
- BEMP improved according to the comments received, but looking for more examples of tangible actions implemented thanks to LCA

Description

- LCA is applicable as a decision support tool at 3 levels:
  1. Meso-macro level decision support
  2. Micro level decision support
  3. Environmental accounting
- Decision support at the *micro-level* represents the most relevant application area of life cycle assessment in industry.
- Useful and practical in the context of environmental management, cleaner production, green procurement, and in the product design process.
- LCA makes it possible to systematically analyse the inputs and outputs of production processes and their environmental impacts and helps to avoid short-sighted environmental management decisions.

Achieved environmental benefits

- Does not lead to improvements in a company's environmental performance; it is thus not useful to measure a company's environmental performance by simply counting the number or ratio of LCAs conducted in a certain management process

Applicability

- Most of the EEE companies conduct in-house LCAs to analyse the burden of the selected products

Economics

- Highly depend upon the objectives of the company, other costs to be taken into account:
  - Labour costs,
  - Software license,
  - Auxiliary/secondary datasets, external consultants
  - Etc….

Appropriate environmental performance indicators

Metrics	Description
%	of product range for which a LCA has been performed (weighed by numbers of references or by sales)

Proposals for benchmarks of excellence:

- Conducting LCA, according to the ISO 14044 standard, for major products that contribute substantially to the overall sales volume as well as at major product development stages

15. Increasing the content of recycled plastics in EEE products

State of play

- Based on previous proposal of BEMP on closed-loop recycling of plastics from inkjet cartridges
- Applicability (e.g. priority to waste prevention and reuse over recycling) was made more prominent
- Looking for further information on which types of plastics can be recycled in closed-loop systems

Description

- BEMP is for an EEE manufacturer to use as much as possible recycled plastics in its products
  - Establishing, when appropriate, closed-loop systems where secondary plastics are obtained from the recycling of post-consumer waste products of the manufacturers collected in a take-back system

Source: Appears courtesy of PDR Recycling GmbH + Co KG and HP, 2014

Achieved environmental benefits

- The use of recycled plastics in the manufacture of new EEE decreases the demand for virgin materials – in this case crude oil.

Applicability

- Need to respect the waste hierarchy
- Secondary plastics may not be suitable if e.g. chemicals they contain were phased out.

Economics

- The costs for recycled plastics depends on the collection and processing efforts required.
- Usually they are in line with costs of virgin material but much more stable compared to virgin plastics

Appropriate environmental performance indicators

Metrics	Description
%	recycled plastic used in the manufacture of EEE out of total plastics use
%	sales of products manufactured with recycled plastics out of total sales

Proposals for benchmarks of excellence:

- N/A

Manufacturing of Electrical and Electronic Equipment Manufacturing

Identification of BEMPs for EEE end-of-life

Overview of the developed BEMPs

No	Title of BEMPs	Target group	Resource efficiency	Water	Waste	Emissions to air, soil and water	Energy & climate change	Biodiversity	Hazardous substances
	END OF LIFE EEE								
16	Design for repair, refurbishment, reuse and recycling	EEE manufacturers	X		X		New BEMP		X
17	Integrated product service offering (IPSO) with effective collection, repair and recycling	EEE manufacturers	X		X		X		
18	High quality refurbishment of used products	EEE manufacturers	X		X		X		
19	Improved sorting solutions for polymers from WEEE	Recyclers	X		X				
20	Improved transport of WEEE	Recyclers	X		X		New BEMP		

16. Design for repair, refurbishment, reuse and recycling

State of play

- New BEMP
  - Include some elements from previous proposed BEMP: '*End-of-Life removability of rechargeable batteries*'
- Scope is now broadened, in particular design for repair/refurbishment is now included

Description

- BEMP is to ensure at the design phase that the product will be easy to repair, refurbish, reuse and recycle.
- To do so, EEE manufacturers can:
  - Arrange components for easy disassembly and accessibility, especially for batteries and parts more prone to damage and break down;
  - Minimise the total number of joints, reduce and eliminate redundant parts;
  - Use modular components;
  - Support the development of a market of spare parts;
  - Etc.

Achieved environmental benefits

- Increased average product life
- Increased share of components that can be reused
- Increased share of materials that can be recycled

Applicability

- Applicable to all EEE manufacturers during the design of new products

Economics

- Difficult to present such figures but:
  - Possibility to attract new customers interested in devices that can be easily repaired or upgraded
  - New market for spare parts and an appropriate network of repairing and refurbishing can be established → source of income for the companies

Appropriate environmental performance indicators

Metrics	Description
%	Reduction of the number of screws and fasteners used in a product
%	Increased product life because of easier reparability and refurbishment
%	Share of components that can be easily removed for preparation or reuse
%	Share of materials that can be recycled

Proposals for benchmarks of excellence

- **N/A**

17. Integrated Product Service Offerings (IPSO) with effective collection, repair and recycling

State of play

- No major changes compared to the background report
- We need more examples from the B2C segment

Description

- BEMP is for EEE manufacturers to provide Integrated Product Service Offerings (IPSO)
  - not only to businesses but also to consumers
  - integrating in the system an effective take-back of the used equipment with a view to repair/refurbish for further use or, when the product is not suitable, to recycle to the highest extent possible.
- IPSO schemes incentivise EEE manufacturers to improve durability, maintenance, possibility to repair easily…
- IPSO schemes are already well established for certain products in the segment of B2B but are a valuable model for broader implementation (further products and B2C).

Achieved environmental benefits

- Improved durability of EEE devices, reducing the WEEE generation
- More effective WEEE collection and recycling (mono-fractions)

Applicability

- IPSO schemes do not work for:
  - small appliances with limited purchasing cost and low bill of materials
  - large (heavy) appliances if the financial/technical value is low compared to transport costs

Economics

- There are significant economic benefits from IPSO business models (e.g. customer retention, extra business opportunities):
  - B2B segment: well established
  - B2C segment: not well established but rapidly growing

Appropriate environmental performance indicators

Metrics	Description
%	Take back rates per product category
%	Reused devices in relation to all devices installed within the IPSO
Years	Average life time of hardware

Proposals for benchmarks of excellence:

- 100% take-back rate for post-consumer devices from leasing contracts and a 30% refurbishment rate

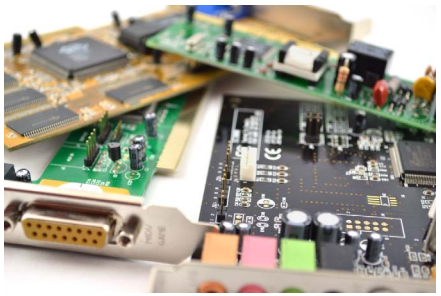
18. High quality refurbishment of used products

State of play

- No major changes compared with the background report
- Content updated in light of the comments received
- We would like examples of spare parts from UEEE

Description

- BEMP is to **prevent waste** by **refurbishing used EEE products**
  - Achieving the **same quality** levels when the products were **first placed on the market**
  - Bringing them into the market for reuse with appropriate **warranty**
- This high quality refurbishing activities are best carried out by (or in close co-operation with) the OEMs



Achieved environmental benefits

- Reduce natural resources and energy use compared to manufacturing of new products
  - In many cases, lifetime extension makes sense even though new products are more energy efficient, but this needs to be checked case-by-case.

Applicability

- This BEMP is applicable to a wide range of EEE products.
- Typically, applicability is higher for devices that are mid- or high-capital intensive (around and above 700-1000 €).

Economics

- In most cases, the market for high quality refurbished products does not negatively affect the sales volume of new devices of the same category (but rather those of cheaper devices).

Appropriate environmental performance indicators

Metrics	Description
Y/N	LCA was used to demonstrate that the refurbishing activities have environmental net benefits, also in light of energy efficiency gains of new product models
%	Sales of refurbished products within a product group in relation to the sales, including new equipment

Proposals for benchmarks of excellence:

1. LCA was used to demonstrate that the refurbishing activities have environmental net benefits, also in light of energy efficiency gains of new product models.
2. The market share of refurbished products is above 5% of the total sales in a product segment.

19. Improved sorting solutions for polymers from WEEE

State of play

- Based on the BEMP that was called 'Innovative sorting solutions for black plastics from WEEE'.
- Scope has been broadened to include other plastics waste streams and sorting techniques
- Content updated in light of the TWG comments

Description

- Amount of black plastics is increasing in the waste stream, difficult to sort especially ABS and PS, among the most common types of plastics in WEEE stream
- Number of available technologies for sorting of plastics:
  - Density-based
  - Optical sorting
  - Laser spectroscopy
  - Electrostatic sorting
- BEMP is to sort out each plastic fraction according to its main polymer types and according to its level of contamination with flame retardants, using more advanced techniques where needed to increase separation rates
- Remark: presence of hazardous substances should be considered

Achieved environmental benefits

- Recycling of plastics from WEEE reduces the demand for primary resources

Applicability

- Available efficient sorting technologies almost fully applicable to all EEE companies
- Technical limitations for the technologies mentioned (emerging or established)?

Economics

- Hard to introduce figures
  - Economics highly depend upon the technology selected

Appropriate environmental performance indicators

Metrics	Description
%	Achieved recycling rates for WEEE plastics
%	Quality/purity ratio of separated fraction for each polymer

Proposals for benchmarks of excellence:

- Black plastics stream: Ability to sort-out black ABS and PS-fractions from mixed WEEE-plastics >98.5% for ABS and > 99% for PS
- For other plastic streams?

20. Transportation of WEEE

State of play

- New BEMP

Description

- BEMP focusses on the measures that should be taken, in order for the material flow to remain as high as possible within the waste hierarchy
- Allow preparation for reuse by maintaining as much as possible the physical integrity of the WEEE and avoid destruction due to transit manipulation
- Ways to achieve goals:
  - Packaging and configuration of loads
  - Transit of shipments
  - Route optimisation and reverse logistics

Achieved environmental benefits

- By avoiding the accidental degradation of waste EEE in transport, these items can remain at higher levels in the waste hierarchy and benefit from higher-grade treatment with associated benefits (e.g. preparation for reuse rather than materials recovery).

Applicability

- BEMP is fully applicable to all companies
- Technical limitations should be taken into account depending on the control exerted on the logistics chain

Economics

- Collection and transportation are generally the most expensive steps of the WEEE supply chain → economic balance may or may not be reached

Appropriate environmental performance indicators

Metrics	Description
%	of WEEE collected which is subject to appropriate packaging to prevent further degradation of the waste products
#	number of times a shipment of WEEE is subject to transfer (vehicle change/container change/repackaging) during transit

Proposals for benchmarks of excellence:

- **X%** of the material can be prepared for reuse