Kick-Off Meeting of the Technical Working Group for the EMAS Sectoral Reference Document on Best Environmental Management Practice in the Telecommunications and ICT Services Sector

Minutes of the meeting

Brussels, 16-17 November 2015

These meeting minutes were developed by Ernst & Young under contract with the European Commission, Joint Research Centre**.**

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I. INTRODUCTION

The European Commission's Joint Research Centre (JRC) is developing a **Sectoral Reference Document (SRD)** on best environmental management practice in the telecommunications and ICT services sector. This document will describe best environmental practices that telecommunications and ICT services providers can implement in order to minimise their environmental impacts.

The elaboration of this document is part of the European Commission's work to implement the EU Eco-Management and Audit Scheme (EMAS) Regulation[1]. EMAS is a voluntary framework for companies and other organisations to evaluate, report and improve their environmental performance. Within this framework, the EU decided in 2009 to develop Sectoral Reference Documents (SRDs) on Best Environmental Management Practice for different sectors. These are documents that EMAS registered organisations must take into account when assessing their environmental performance, but can also be used by others looking for guidance on how to improve their environmental performance. The telecommunications and ICT services sector is one of the priority sectors for which these documents are developed. Further information on this background is available in the JRC report "Development of the EMAS Sectoral Reference Documents on Best Environmental Management Practice"[2] and on the following website: http://susproc.jrc.ec.europa.eu/activities/emas.

For the development of the telecommunications and ICT services SRD, the JRC established a European technical working group (TWG), comprising experts in different aspects of environmental sustainability within the sector. The TWG assists the European Commission in identifying the best practices to be described and then validate the final findings. The kick-off meeting of the TWG was held in Brussels on 16-17 November 2015. The goal of the workshop was to establish the information exchange between the members of the TWG and to begin steering the development of the document, discussing its scope and the preliminary best environmental management practices identified.

Ernst & Young (EY) was contracted by the JRC to prepare a background document to be used as a basis for the development of the sectoral reference document and a draft version of this background report was sent to the TWG members prior to the workshop.

II. OPENING OF THE WORKSHOP

The JRC opened the session and welcomed the participants. After a brief explanation of the meeting procedure, an introduction to the workshop and overall exercise was given.

- The meeting agenda was presented (see Annex A) and agreed by the participants.
- The TWG members introduced themselves and summarised their experience in the telecommunications and ICT services sector and environmental issues (the list of participants is attached in Annex B).
- Participants were informed that the meeting would be recorded. There were no objections to this.

[1] Regulation (EC) 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC, OJ L 242/1, 22.12.2009

[2] http://susproc.jrc.ec.europa.eu/activities/emas/documents/DevelopmentSRD.pdf

- It was agreed to use first names to address the TWG members in discussions and the same convention is adopted to refer to participants in these meeting minutes.
- The JRC emphasised that at the stage of the kick-off meeting it would not be necessary to agree on every point, as the document will continue to be developed over the following year.

III. DAY 1, SESSION 1: PURPOSE AND GOALS OF THE MEETING

The JRC introduced the framework of the EMAS Regulation, the methodology for developing the SRDs and the purposes and goals of the meeting.

- After introducing the basics of an Environmental Management System (EMS), the JRC explained that EMAS is a voluntary environmental management tool available to any kind of organisation to evaluate, report and improve its environmental performance.
- The process for developing EMAS Sectoral Reference Documents (SRDs) on best environmental management practices (BEMPs) was described. The BEMPs should provide practical guidance and propose appropriate environmental performance indicators and benchmarks of excellence already demonstrated by best environmental performers. It was also explained that the documents go beyond EMAS, offering support and being a source of information for all organisations that wish to improve their environmental performance.
- The aim and content of each document that will be developed (Background Report, Best Practice Report and the SRD) was introduced. The idea is that the SRD should promote BEMPs, but there are no obligations to EMAS organisations to implement specific BEMPs. The draft Background Report that was shared prior to the meeting is not a finished document, but open for discussion.
- The JRC presented the goal of the TWG kick-off meeting, which is to discuss and agree on the scope of the document and the potential best environmental management practices. The BEMPs should target organisations within the telecommunications and ICT services sector, but can also be relevant for other sectors. The JRC stressed how essential it was that the TWG members contribute as much as possible to the development of the SRD to ensure its quality and usefulness for the targeted companies and other organisations.
- Over the coming months, feedback and inputs from the TWG will be collected and an updated Background Report will be prepared. A final meeting of the TWG (planned for late 2016) will validate the BEMPs and agree on environmental performance indicators and benchmarks of excellence.

IV. DAY 1, SESSION 2: INTRODUCTION OF THE SECTORAL REFERENCE DOCUMENTS ON BEST ENVIRONMENTAL MANAGEMENT PRACTICE (BEMP) AND LESSONS LEARNT

The JRC gave an overview of how the previous Sectoral Reference Documents (SRDs) for other sectors had been developed, as well as their structure. The approach and general structure will be the same for the document covering the telecommunications and ICT services sector.

The presentation focused on the meaning of specific terms used in the context of the SRDs (best environmental management practices, environmental performance

indicator, benchmarks of excellence), along with examples from the SRD for the retail trade sector.

- **Best Environmental Management Practices (BEMPs)** are techniques, measures and actions that allow organisations to minimise their direct and indirect environmental impacts. They should go well beyond common practices, should be fully implemented by best performers and be widely applicable. The TWG is responsible for determining whether the practices identified so far refer to actual BEMPs, or to techniques which are either common, obsolete or emerging.
- **Environmental performance indicators,** which can be quantitative or qualitative, are required to allow organisations to measure their performance. The focus is on indicators that are already in use and environmentally meaningful, but which can be a proxy. The approach used to identify BEMPs, by analysing the practices implemented by 'frontrunners' (i.e. companies that go beyond the minimum in terms of environmental performance), was also presented.
- **Benchmarks of excellence** refer to a level of performance that is very ambitious (e.g. top 10 or 20% of the performance of companies in the sector), achieved by frontrunners and measuring of what is possible (which is not necessarily a target).

The outputs of the process of defining BEMPs were outlined:

- The background document (**Best Practice Report**) is intended to be a detailed technical guide that contains full details of the BEMPs that were developed in collaboration with the TWG.
- The final **SRD (Sectoral Reference Document)** is a short synopsis of the best practices, indicators and benchmarks. This is the official document that EMAS registered organisations can refer to.

DG Environment explained the **interaction between EMAS and other policy instruments** and pointing out that:

- EMAS targets organisations (and not products, components or services),
- EMAS is a voluntary scheme (compared to a mandatory regulation),
- EMAS is open to all organisations operating in all economic sectors, but also provides some specific sectoral information (through SRDs)
- EMAS is about environmental management (and not just communication, reporting or innovation).

The session ended with JRC presenting the **lessons learnt** from the development of BEMPs and SRDs in other sectors:

- The key role of the TWG is to validate findings and draw conclusions on environmental performance indicators and benchmarks of excellence.
- The composition of the TWG may change from kick-off to final meeting, and experts which have not assisted to the kick-off meeting can join the work on the SRD.
- Experts can send comments in an informal way, e.g. by just sending an email (no template).

Discussion:

- The **need and added-value of conducting the work and developing an SRD** for the telecommunication and ICT services sector was challenged.

  - Many documents and initiatives related to best practices already exist (EU Codes of Conduct, ETSI standards, Green Grid, Data Centre Maturity Model, etc.).
  - The technologies and practices in the telecommunications and ICT services sector are moving very fast which could result in the production of an obsolete document by the time the SRD will be published.
  - The JRC responded that the SRD would go beyond energy aspects and include indirect aspects related to customer activities. The work does not aim to reinvent the wheel, but build on on-going work by collecting information and demonstrating how organisations can improve their environmental performance even more. The JRC acknowledged that the SRD should be continuously revised, but there were limitations on costs and resources. It was proposed that instead of detailing techniques, the BEMPs should make reference to documents and standards that are regularly updated (e.g. the EU Codes of Conduct).
  - The JRC added that while the **Best Practice Report is produced only in English**, the SRD will be available in all official EU languages.
- **The process for selecting best practices** and **the use of the SRD** were questioned.
  - The participants agreed that the SRD should be developed on the basis of work already done (including the EU CoC on Data Centres, the ETSI standards, etc.), but could be useful by supporting other environmental aspects than only energy efficiency (raw materials, waste management, etc.).
  - The JRC emphasized that BEMPs should be both already implemented and quite disruptive, but should not just be ideas of potential practices to be deployed in the future. They also recalled that BEMPs should target organisations and what they can do (and not the customers of telecommunication and ICT services).
  - Defining and describing BEMPs for organisations that that have significant ICT activities, but are not necessarily part of the telecommunications and ICT services sector (e.g. banks, manufacturers, public administration, etc.) was also agreed to be useful.
- It was pointed out that the current report fails to refer to existing standards – particularly from ETSI.
- Participants encouraged not to invent new Key Performance Indicators (KPIs) as there is no need for more KPIs.
- It was also suggested to structure the BEMPs better by focusing on the applicability, e.g. some BEMPs are only relevant for large data centres and not small server rooms.

V. DAY 1, SESSION 3: OVERVIEW OF THE TELECOMMUNICATIONS AND ICT SERVICES SECTOR AND DEFINITION OF THE SCOPE OF THE SECTORAL REFERENCE DOCUMENT

EY presented a brief overview of the telecommunications and ICT services sector in Europe and proposal of scope of the SRD:

- The main target group of the SRD are the companies in the telecommunication and ICT services sector, identified according to their NACE Code. The list of

these economic activities was introduced and discussed. The European statistics related to these companies (number of companies, number of employees, turnover, size of companies, geographical distribution) were described. It was however also recognised that organisations in other sectors could also benefit from the SRD.

- The BEMPs aim (i) to monitor and minimise the environmental impacts of core activities of the telecommunications and ICT services sector (e.g. planning, operating and managing data centres and telecommunication networks), but also (ii) to help the clients and end-users of the telecommunications and ICT services sector (which benefit from telecommunications and ICT services) to reduce their own environmental impacts. The list of the telecommunication and ICT services activities to be taken into account and the description and quantification of their related environmental pressures were presented and discussed. The involvement of telecommunication and ICT services providers within EMAS was detailed.

Discussion:

Definitions and terminology:

- The participants asked for a **common definition of the words** used in the report (e.g. data centre, reuse and recycling, etc.), in order to ensure a common understanding among all actors across the different areas and responsible for various activities.
- The title **'desktop infrastructure'** was not considered appropriate. It was suggested to replace it by 'end-user devices'.
- A participant suggested the use of **the terminology 'greening for ICT'** (for reducing environmental impacts generated by the ICT sector itself) and **'greening by ICT'** (for the enabling role of ICT to reduce environmental impacts in other sectors) as this was commonly used in the sector.

SRD structure:

- Participants underlined the interest of **addressing the specificity of each activity**, in terms of business (e.g. banks have specific IT requirements and architecture) or size (e.g. techniques can be different between small server rooms and large data centres). This information could be developed within the 'applicability' section of each BEMP. An overview table will be added in order to guide organisations in finding the relevant BEMPs in relation to the size and type of their organisation.
- The **development of the topic 'greening by ICT'** was discussed as much relates to potentials and not actual achievements. The idea is to demonstrate real examples of how ICT can reduce environmental impacts in other sectors. The JRC pointed out that the SRD will focus on BEMPs that can reduce environmental impacts that are directly related to companies in the telecommunications and ICT service sector. The BEMPs that deal with reducing (indirect) environmental impacts in other sectors will be done by giving examples of success stories.

Scope of BEMPs:

- **The scope presentation was not considered clear enough** by several participants. There was confusion due to the different perspectives used to define the scope. It was proposed to define the **scope by type of business / organisation** (e.g. telecommunication provider, broadcasting company, software company, ICT consultancy, etc.); **by ICT asset** (e.g. data centres, end-user devices, telecommunication network and infrastructure, software,

etc.); and, **by type of activity** (e.g. managing a data centre, maintaining the telecommunication network, computer programming, etc.). An example was provided for clarification: while manufacturers of ICT equipment are not targeted with this SRD (they are the focus of the SRD for the electrical and electronic equipment manufacturing sector), this SRD will develop BEMPs that telecommunication and ICT services providers can implement, e.g. establishing environmental criteria during procurement of ICT equipment. Likewise collection of used ICT equipment at their end of life could be considered a BEMP, but waste management companies are not part of the scope.

- The **use of the NACE classification** for categorising targeted companies was thought to be confusing and misleading. The JRC explained that this classification is the formal reference that should be used in the SRD, but recognised that the NACE codes for the telecommunications and ICT services sector in particular do not fit the business activities very well, contrary to other sectors. Participants agreed on the structuring the BEMPs by activities within organisations related to ICT assets, instead of NACE classifications, which will only be mentioned in the introduction of the document.
- The NACE class covering '**the installation of mainframe and similar computers**' was thought to be inappropriate and it was suggested to remove it from the scope.

Statistics on the sector:

- The available data (based on NACE codes) describing the sector in the EU (e.g. annual turnover, number of companies and employment) was not thought to be reliable. This should be clearly mentioned in the documents.
- When asking for better data to describe the sector (e.g. the total number of data centres in the EU), the participants replied that there were no reliable statistics available to properly describe the sector. Estimates could be based on the number of processors sold but it would depend on how data centres are defined (e.g. a single cabinet could be called a data centre). Despite these shortcomings, the JRC reaffirmed the need for such data to be presented to provide policy makers an overall view of the sector.

VI. DAY 1, SESSION 4: ENVIRONMENTAL ASPECTS OF THE TELECOMMUNICATIONS AND ICT SERVICES SECTOR

EY presented the environmental issues related to the telecommunications and ICT services sector and the overview of all the BEMPs identified.

- The **main environmental pressures** (e.g. energy consumption, waste production, landscape impacts, electromagnetic radiation, etc.) of each of the four ICT assets that are the focus of the BEMPs (i.e. data centres, ICT equipment, telecommunication infrastructure and networks, broadcasting services) were presented.
- The **relationship between the BEMPs and the EU Code of Conduct** (CoC) on data centres and broadband equipment was described in terms of scope and use.
- The **full list of the BEMPs** identified so far and structured according to assets (i.e. data centres, ICT equipment, telecommunication infrastructure and networks) was presented.

Discussion:

Scope of environmental aspects:

- It was suggested to include **transportation issues**, related to the maintenance and management of network infrastructures. EY explained that this question had been studied, but that no relevant BEMP had been identified so far. Research in this area will continue. Any increases in transport as a result of a BEMP will at least be described in the cross-media effects section of the relevant BEMPs. The term cross-media was clarified by the JRC to refer to environmental media such as air, water and soil, i.e. cross-media effects refer to negative impacts on other environmental pressures due to the implementation of a BEMP. The JRC explained that the use of the term will be maintained in order to be consistent with the other SRDs.
- Other sources of landscape impact were identified as important: **power lines and (data centre) buildings**.
- Fire extinguishers were mentioned as a source of ozone depleting substances.

Environmental pressures:

- **Noise and heat production** were mentioned as relevant environmental pressures which should be included.
- The effects of (waste) **heat rejection** (in the form of warmer water or steam) on increasing the temperature of the local environment and disturbing ecosystems were mentioned.
- The issue of **prioritising different environmental pressures** was raised. A participant illustrated this point with an example: the reuse of IT equipment can be beneficial from a raw material point of view, but not necessarily with regards to energy consumption (e.g. energy savings resulting from the use of a newer and more energy-efficient server are often greater than the energy required to produce new equipment).

Proposed list of BEMPs:

- The use of the terminology **'effectiveness'** when speaking of electronic equipment was proposed instead of 'efficiency' (e.g. PUE is Power Usage Effectiveness – not efficiency). Similarly, the expression **'renewable energy'** was suggested, instead of 'alternative energy'.
- Data centre experts thought that the BEMP entitled **'reducing energy losses due to electricity conversion'** was not relevant in Europe and more applicable in America. Telecommunication experts thought that the BEMP might still be relevant for certain telecommunication network equipment.
- **Green software** was identified as a promising practice, but not well defined or applied (partially due to a lack of demand from users). It was suggested to collect more information and to assess at a later stage the relevance of describing green software a BEMP or just as an emerging technique.
- Different participants insisted on the necessity of taking into account of **rebound effects** when defining BEMPs (e.g. when equipment becomes more efficient, people will just use it more). This will be addressed within the 'cross-media effects' section of any relevant BEMP.

Structure of the SRD and the relationship to the EU Code of Conduct:

- Participants involved in the development and revision of the **EU CoC on data centres** explained that it consists of a set of best practice guidelines as well as a registration scheme. The CoC best practices are currently being developed into a new standard (CLC/FprTR 50600-99-1).

- A participant suggested integrating techniques related to the **reuse of heat** within the BEMP focusing on 'Efficient cooling technologies and systems' instead of the BEMP related to 'Airflow and management settings'. Airflow management does not allow implementing the reuse of heat, if this is not already included into the cooling system.
- The formulation of the two BEMPs related to material consumption and waste management (Chapter 7) was not considered as clear enough.

After this session, the meeting analysed and discussed each of the proposed best environmental management practices (BEMPs). The numbering of BEMPs and chapters follows the numbering in the draft Background Report that was circulated to the TWG members ahead of the meeting. This will change in future versions of the document.

VII. DAY 1, SESSION 5: TECHNIQUES TO IMPROVE THE ENERGY PERFORMANCE AND MINIMISE THE ENVIRONMENTAL IMPACTS OF DATA CENTRES

EY described the four BEMPs related to the reduction of energy consumption and other environmental impacts of data centres:

- **(BEMP 4.2) Better locating and planning data centres** included:
  - Better locating data centres (for potential reuse of waste heat, opportunity for implementing free cooling, availability of renewable sources, etc.);
  - Designing a more-energy efficient data centre;
  - Building a modular data centre to avoid oversizing.
- **(BEMP 4.3) Optimizing data centre utilisation and management** relates to optimising data centre utilisation and management through data storage management and server consolidation (including virtualisation).
- **(BEMP 4.4) Efficient cooling technologies and systems** consisted of techniques related to the implementation of efficient cooling technologies and systems (centralised air handling, free cooling, liquid cooling, etc.).
- **(BEMP 4.5) Airflow and settings management and reuse of heat** included different techniques related to the airflow design (hot/ cold aisles, containment, etc.), the setting of temperature, humidity and volumes of air and heat reuse.

The identified environmental benefits, environmental performance indicators and cross-media effects were also presented for each BEMP, but it was agreed on focusing on the relevance of each BEMP and not on the indicators as this would be determined at a later stage.

Discussion:

Definition of a data centre:

- There are many different definitions for a data centre as it can be applied to different types of installations. It was suggested to **use the definition from the EU Code of Conduct (CoC) or from the ETSI standard**.
- The Background Report should **make more reference to related current standards**.

Scope and applicability:

- Several participants expressed the importance of including BEMPs applicable for all types of organisations and installations; including **existing small server rooms,** which currently represent the biggest potential for energy savings. It was decided to define for each BEMP the types of data centres and server rooms that can implement such techniques, by using contextualising indicators (e.g. type of business, type of operator, size and age of the installation, geographical location, etc.). This information will be included within the 'applicability' section of BEMPs.
- An expert in telecommunication infrastructures explained that many of the BEMPs **can also be implemented in central offices**.
- The BEMP related to **geographical location** was challenged and criticised by several participants who considered that such practice would not be widely applicable and could lead to significant cross-media effects (e.g. longer distance to transport data, etc.). Niek provided two studies: *SURF (2013) Transporting Bits or Transporting Energy: Does it matter? A comparison of the sustainability of local and remote computing* and *Newcombe, L. (2011) IT environmental range and data centre cooling analysis. Assessment of the impact of IT inlet temperature and humidity ranges on data centre cost and overall energy consumption.*
- It was suggested to assess the **total cost of ownership to determine the best practices**.

Relevance of BEMPs:

- Several participants thought that it would be better to **focus more on changing behaviours and improving the management of data centres** since these issues represent important barriers to real energy savings. This could include appointing an energy efficiency champion, defining an energy efficiency strategy, improving governance and ringfencing (i.e. allocating specific funds) for energy efficiency improvements.
- Some of the techniques listed within the different BEMPs (especially concerning efficient cooling systems) were not considered as always **being best practices**, as it depends on the context. It was suggested to refer to categories of techniques and describe in which cases they would be applicable as best practices. For example, free cooling can be used in Mediterranean areas for partial loads, but not at full load.
- In relation to cooling systems, a participant claimed that it is not possible to get a license for using groundwater to cool data centres in the UK. In Amsterdam however there is a data centre that uses hot and cold wells to regulate the temperature. Ice storage is other technique that could be considered. It has been used in the UK for over 6 years. There are four cooling technologies mentioned in the Background Report, but according to an expert there are 10 in practice.
- For some companies such as banks, resilience is more important than energy efficiency.
- Sometimes regulations and environmental guidance conflict. For example BREEAM and LEED give points for increasing insulation of data centres.

Indicators:

- The use of the **PUE (Power Usage Effectiveness)** as an environmental performance indicator for data centres was criticized since this indicator is relatively 'old' and is not sufficient for monitoring the energy effectiveness improvements of data centres (for example, a decrease in the PUE value can be observed, without a decreased in the energy consumption of the data

centre). Nevertheless, participants agreed that the indicator is widely used by data centre operators and that currently there is no better indicator as simple and as encompassing as the PUE. According to the experts, the Data Centre Infrastructure Efficiency (DCiE) indicator was not used anymore.

- The experts proposed other **indicators** (e.g. Renewable Energy Factor (REF)[3], Carbon Usage Effectiveness (CUE), Water Usage Effectiveness (WUE), IT Equipment Efficiency (ITEE), etc.). It was pointed out that the proper monitoring of the energy effectiveness of a data centre requires the use of several indicators.
- The indicators should be mainly be used for **monitoring the progress energy performance of a data centre, and not for comparing different data centres**, because there is a large diversity of data centres (e.g. depending on their geographical location, the level of resilience, data centre requirement tier level, etc.). Identifying benchmarks of excellence can be difficult and some companies could take advantage of this when communicating on their performance.
- A participant highlighted the importance of **defining relevant indicators** (e.g. computing capacity / m² for land footprint) instead of defining the indicator in absolute terms (e.g. just m²).

Relationship with the EU Code of Conduct (CoC) on data centres:

- As several participants had been involved in the development or revision of the EU CoC on data centres, they thought that the proposed BEMPs would confuse the sector as it **overlaps with the 150 best practices in the EU CoC on data centres**. Although the CoC describes the best available practices, it is not complete. The BEMPs proposed here are broader and more information is provided. The CoC is only about energy efficiency at the moment, but at the last meeting in Ispra on the CoC, it was agreed to define best practices for sustainable data centres beyond energy efficiency. The applicability of the best practices and contextual information is currently missing from the CoC.
- The **EN 50600 standard** *(CLC/FprTR 50600-99-1 Recommended practices for energy management)* currently in development is based on the CoC structure. It will be adopted soon (2016) and was proposed as a reference for data centre related BEMPs and could be used for structuring the SRD. The SRD could then complement the standard with additional information on applicability, operational data, economics, etc.).
- Targets or benchmarks of excellence could be proposed based on application and climate without referring to a specific technology, e.g. in northern Europe the benchmark would be *x*, whilst in southern Europe the benchmark is *y*. This is possible to do, but it would depend on whether the evidence for this was already available.
- In order to improve the relationship between the SRD with the CoC on data centres, three options were proposed:
  - **Option 1:** Develop only one BEMP making reference to the implementation of the best practices included in the CoC
  - **Option 2:** Develop BEMPs making reference to each of the clusters of the best practices in the CoC
  - **Option 3:** Complement each existing best practice listed in CoC by developing the applicability, economics, cross media effects sections
- **The participants agreed to option 2** for the next revision of the Background Report. Option 1 was assessed to be difficult to follow for a non-specialist, while option 3 was thought to be too detailed. The BEMPs will then be linked to

[3] The standard is due to be published soon

the CoC or the EN 50600 standard titles and terms. Both the mandatory and optional best practices will be included. The SRD will not describe the practices in detail, but will focus on providing complementary information about applicability of the best practice, operational data, economics, etc. Related BEMPs about other ICT equipment (e.g. end-user devices) and telecommunication networks will be described separately.

- On the question of whether the overall structure and headings of the CoC and standard will change over time, no guarantees could be given.
- **EY will propose a new structure for the BEMPs and submit it for approval to the TWG**.

Other comments:

- There was a discussion between the participants on the ASHRAE guidelines and to what extent allowable temperature and humidity ranges could be recommended. Some argued that the ASHRAE guidelines were an inhibitor to energy efficiency, while others maintained that manufacturers' warranties were based on ASHRAE.
- The BEMP on 'Better locating and planning data centres (4.2)' was proposed to be renamed **'Optimise the data centre for local conditions'** to cover both selecting an optimal location and optimising the data centre for whatever the local conditions might be. The Green Grid has published a report: *Sustainable Site Selection: The Convergence of Data Center Site Selection and Sustainability (2013)*.
- **Kurt** shared the link to the *CEN/CLC/ETSI document: Standardisation landscape for the energy management and environmental viability of data centres (2015)*.
- The **'reuse of heat' should be a separate BEMP** (and not together with 'Airflow and settings management'). According to a participant, it is not a good idea to place data centres close to swimming pools as the coils will corrode.
- **Mark** shared a paper on *The Business Case for Sustainability in Data Centres* by Robert Tozer.

VIII. DAY 1, SESSION 6: TECHNIQUES TO IMPROVE THE ENERGY PERFORMANCE OF ICT EQUIPMENT

EY introduced the two BEMPs related to the reduction of energy consumption and other environmental impacts of ICT equipment.

- **(BEMP 5.2) Procurement for sustainable equipment** concerns the integration of energy-efficiency and environmental criteria in the procurement policy.
- **(BEMP 5.3) Improving the energy efficiency of ICT equipment** related to organisational and technical solutions that can be implemented in order to improve the energy efficiency of ICT equipment through a better utilisation and management.

Discussion:

Structure and scope:

- The BEMPs were considered to be **too computer oriented**. It was suggested to broaden the BEMPs to include all types of ICT equipment (e.g. servers, end-

user devices, network equipment, etc.). Two possibilities were identified: the first one is to list the different equipment considered and to detail the specificities of each; and, the second option is to develop these two BEMPs for each ICT asset (data centre, network, etc.). EY will make a proposal when developing the revised structure of the report.

- **Software** was considered as an important aspect missing within these BEMPs since it is a central aspect when speaking of the functioning of equipment or networks. Although there was interest in developing another BEMP related to energy-efficient software, the participants confirmed that there was limited relevant information available on this topic. Most of these practices are still under development and software developers do not communicate intensively on the energy-efficiency of their software since this is currently not a demand from customers.
- Another way of reducing energy consumption is to optimise the **quality of service and data management**. While this can be an efficient approach to reduce data transfer, processing and storage, it is not widely implemented. EY indicated that this aspect would be developed within the BEMPs related to networks.

Relevance of BEMPs:

- The criteria defined for purchasing sustainable ICT equipment were considered as not comprehensive enough (for example, existing eco-labels do not cover all types of ICT equipment). It was suggested to also refer to the **minimum energy performance standards** that do exist and to include performance based procurement criteria (e.g. coefficient of performance (COP) for cooling equipment).
- Participants highlighted that energy performance of equipment is only provided at full load, but most ICT equipment operate at **partial loads** (especially when considering end-user devices). The EU CoC on broadband equipment does however provide recommend power levels at different operation states, and the Energy Star set requirements at 20% load.
- The BEMP related to procurement focuses on products, but most of the telecommunication and ICT services providers also purchase services. This BEMP should also deal with **environmental criteria when purchasing services** (cloud computing, for example). At present, there are no labels or standards for ICT services.
- **Communication and behavioural BEMPs** were highlighted again as important, and it was suggested that the BEMPs focus more on these aspects.
- **The decommissioning of old equipment** was identified to be a very effective technique to improve energy efficiency and should be mentioned with the second BEMP related to ICT equipment. Currently servers are mainly replaced to increase the capacity of a data centre: this generally reduces the energy per bit processed but does not reduce the energy consumption of the data centre.
- **Total cost of ownership** should be applied when purchasing ICT equipment to provide appropriate ways of comparing equipment.

Indicators:

- The **degree of sharing multi-functional ICT equipment** suggested to be tracked by **number of people per device**.

Additional sources of information:

- The European Commission has developed **Green Public Procurement** criteria which could be used for defining BEMPs to be implemented.

- Electronic displays will have new energy labels next year.
- It was suggested to contact **DG GROW** as they are currently working on the definition of indicators to measure the energy efficiency of servers (Lot 9) under the Ecodesign Directive.
- The Standard Performance Evaluation Corporation (SPEC) website provides relevant performance benchmarks that can be applied to the newest generation of high-performance computers. It is typically used by facility managers and not IT people.

IX. DAY 1, SESSION 7: CROSS-CUTTING MEASURES APPLIED TO MINIMISE ENERGY CONSUMPTION AND CARBON FOOTPRINT

EY described the three cross-cutting BEMPs that were considered to be applicable for all ICT assets (data centres, telecommunication networks, end-user devices, etc.):

- **(BEMP 6.2) Use of alternative energy** related to the using renewable energy (either purchased or produced on-site);
- **(BEMP 6.3) Reducing energy losses due to electricity conversion** focused on reducing energy losses due to electricity conversion, by installing highly efficient and modular UPS or by running on DC power;
- **(BEMP 6.4) Energy monitoring and management** described general practices related to energy monitoring and management.

Discussion:

Renewable energy:

- Most of the examples provided regarding on-site production of renewable energy are **academic research and pilot projects**.
- A well implemented technique is to encourage customers to purchase renewable energy certificates, which is particularly applicable for colocation data centres.
- It was suggested not to use Carbon Usage Effectiveness (CUE), but Renewable Energy Factor as the environmental performance indicator.

Energy losses due to electricity conversion:

- **From a data centre operator perspective**, the BEMPs proposed such as installing high-efficient UPS and running data centres on DC power are **not applicable in Europe**.
- **From a telecommunication network operator perspective**: BEMPs that address power conversion losses should still be considered.
- There was a discussion on eco-loads and whether it should be recommended practice. This depended on the power grid in the country.
- A participant mentioned that the BEMP should not just relate to the technology, but also to the behaviour and how it is used. For example, in the UK the Carbon Trust provides a tax relief on certain equipment with energy efficiency features. Although many operators benefit from the tax relief, they never actually use these features.

Energy monitoring and management:

- The participants agreed that **installing separate metering tools** is a BEMP, since most organisations do not even know the energy consumption of their

server rooms. According to a participant, the wiring regulation in the UK requires all equipment using 16A or more to be monitored individually.

- There is however a risk of **over-metering** since deploying a lot of sensors and meters can produce large quantities of data which are not analysed. In such cases, installing automated systems is not necessarily a best practice. It is better to have sensors placed in the right location and acting on the data that is gathered than trying to monitoring everything.
- The installation of **smart meters** can help users when managing their ICT equipment.
- Optimising the quality of service was mentioned again as a possible BEMP. Often the quality of service can be reduced to save energy.
- Different **process-oriented indicators** were suggested in order to assess the quality of the energy management system implemented:
  - the definition of an energy strategy,
  - implementation of an energy management system (e.g. ISO 50001),
  - the share of the budget allocated for implementing energy-efficiency actions;
  - the percentage of load monitored.

The JRC called the day to an end by thanking all participants and encouraging them to continue providing feedback on the second day as on the first.

X. DAY 2, SESSION 8: TECHNIQUES TO IMPROVE RAW MATERIAL CONSUMPTION AND WASTE MANAGEMENT PERFORMANCE

EY described the two BEMPs related to the reduction of raw material consumption and to the improvement of waste management performance.

- **(BEMP 7.2) Improving waste prevention** intends to extend the life of ICT equipment and to ensure that they are used in an optimal way during their entire life;
- **(BEMP 7.3) Improving WEEE collection, recycling and recovery** is about managing the end-of-life of ICT equipment.

Discussion:

Structure and relevance of the BEMPs:

- **The scope of the BEMPs need to be clarified**, with for example repair and refurbishment belonging to waste prevention.
- A few participants thought that it was strange that **Life Cycle Assessment** (LCA) was specifically mentioned in the first BEMP as LCA is applicable more generally and could be used in almost every BEMP.
- LCA and other tools could be used to **better inform customers** on the environmental impacts of the products they purchase (e.g. PEP ecopassport (http://www.pep-ecopassport.org/)). Comparing different ICT products (from different companies, different countries, etc.) can be complex and is not considered as totally reliable yet. It may be feasible to use it internally in a company.
- A participant suggested introducing the practice of **standardised components and accessories** within these BEMPs since telecom operators and

broadcasting companies can have a great influence on manufacturers through product specifications. The aim is to encourage the greater use of universal equipment (e.g. chargers, modems, etc.), in order to reduce the need for new products and parts.

- Telecom operators have an influence on the eco-design characteristics of end-user devices and can play a role at their end-of-life. For example, modems and set-top boxes can be **designed in a way that facilitates the recovery of components and materials** by easier disassembly or **avoiding hazardous substances** (e.g. brominated flame retardants).
- Different practices were suggested to improve the life of ICT products, e.g. **offering used products to employees** in return of a few euros, creating an **internal system of sale or exchange of equipment between departments** or donating to charity.

Applicability:

- The BEMPs were considered as **too computer and server oriented**. It was suggested to also include UPS, telecommunication equipment and cooling equipment (including chillers and refrigerants).
- There was a discussion on whether a **reuse market** existed for all ICT equipment. For some products, particularly end-user devices, the market in Europe was thought to be limited. Servers on the other hand are high-value equipment. IBM has high rates of reuse of their servers through their asset management and recovery services. The **ownership of equipment** also determined the applicability of certain BEMPs. For example, IBM equipment can be offered as 'IBM owned', 'IBM leased' or 'customer owned'. In the first two cases, IBM can decide the optimum solution. IBM reuses the entire server, subassemblies and parts. Only 0.5% of recovered equipment is sent to disposal. Interxion also has a high reuse rate of 95%.
- Other major **differences were identified between end-user devices** (the majority of impacts occur during the production phase) and **servers** (the majority of impacts occur during the use phase). That explains why replacing servers every two years can be interesting in terms of energy consumption, but requires continuous improvement of recycling techniques. Replacing servers are often driven by demand for capacity increase and not just about energy consumption. Niek shared a Dutch report on the age of servers and energy saving potential: *Cerios Green (2014) Zervers, zuinige servers een verkennend onderzoek naar energiebesparingspotentieel in ICT omgevingen*.
- The implementation of **take-back schemes** faces difficulties related to customers' behaviour. Most customers keep their mobile phones and the take-back recovery is only 10%.
- Some mobile operators do not provide chargers to customers, if they already have one.

Indicators:

- Different indicators were proposed:
  - **the share of equipment going to landfill**;
  - **the share of mobile subscriptions renewed without a new phone.**

Cross-media effects:

- Take-back schemes that donate to **charity** increase the life of ICT equipment, but can lead to uncertainties in terms of recycling and recovery systems deployed in developing countries. Another possible risk is that such programmes are a way to export waste (i.e. the ICT equipment that is 'donated' does not function anymore) and avoid European waste legislation.

- There are pros and cons for using less developed countries for recycling ICT equipment and recovery of materials. **Shredding** is a recycling technique largely deployed in Europe (due to lower costs compared to manual disassembly) which leads to loss of significant quantities of precious metals. Manual dismantling is expensive in Europe due to labour costs. Labour costs are lower in less developed countries, but there is a higher risk of environmental and health impacts related to **informal dismantling**. Hybrid processes with manual disassembly can lead to 60-70% recovery of materials.
- The removal of data from ICT equipment was pointed out as an important aspect to be taken into consideration.
- There was a discussion regarding **flame retardants**, which are toxic and make the recycling more difficult, but are required to reduce fire risks and particularly important for servers and cables. The International Electronics Manufacturing Initiative (iNEMI) has projects related to more sustainable materials and substances that could be used.
- The plastic content of ICT equipment can be significant. The variety of different plastics used in ICT equipment make plastic recycling difficult.

Additional sources of information:

- **Flavio** can share experiences on requirements that Telecom Italia applies to increase recyclability (e.g. specifications for modems that include limiting the amount of plastics, avoiding screws and avoiding brominated flame retardants) as well as examples of recovery performance indicators.
- **Kurt** can share best practices for the reuse of servers.
- **Bob** can provide info on a UK government initiative for reselling and reuse of ICT equipment (similar to an Ebay platform) as well as how closed loop material recovery can be achieved.
- The Background Report for BEMPs for the electrical and electronic equipment manufacturing sector provides more information on the use of substances and materials in products:
    - http://susproc.jrc.ec.europa.eu/activities/emas/documents/BEMP_EEE_BACKGROUND_REPORT_FINAL_April-2015.pdf

XI. DAY 2, SESSION 9: TECHNIQUES TO IMPROVE THE ENERGY PERFORMANCE OF TELECOMMUNICATION NETWORKS

EY presented the techniques identified in relation to the reduction of the energy consumption of telecommunication networks.

- **(BEMP 3.2) Reengineering wired networks for introducing more energy-efficient technologies** focused on wireline networks, with practices of installing new technologies (e.g. optical components, passive network, etc.) and more energy-efficient ICT devices;
- **(BEMP 3.3) Designing and managing an energy-aware wireless network architecture** dealt with wireless networks, and the optimisation of their architecture and management (e.g. heterogeneous design, cooperation, etc.) and the installation of more energy-efficient equipment in base stations;
- **(BEMP 3.4) Dynamic traffic optimisation through green routing and radio resource management** concerned both wireless and wireline networks and described techniques that allow data traffic to be dynamically optimised (e.g. smart standby, dynamic scheduling transmission, etc.).

Discussion:

Structure and relevance of the BEMPs:

- **The overall structure of the chapter was not considered clear enough**, especially on which of the network segments (e.g. the internet service provider's network, terminals, etc.) each technique could be applied.
- Participants were concerned that most of the techniques proposed were **business as usual practices** (e.g. the shift to optical fibre networks is already happening). By the time the SRD is published most of the techniques will be already implemented. There was a suggestion to focus on next generation techniques such as improvements to sea cables. It was also mentioned that while there is a push for fibre all the way to the end-consumer, it has to be checked whether this is actually the best solution.
- **Dynamic traffic management** was however still a relevant BEMP, especially for wireline networks (by installing modular equipment and using protocols and applications). The management of networks should be emphasized in the BEMPs.
- The information in the report was considered to be outdated. **Energy consumption has become a strategic issue** for telecom operators. It represents between 15 and 50% of operating costs, and significant resources have been committed to innovate and integrate energy efficiency within network management. The participants recognised the difficulties of accessing information on the latest best practices as operators do not share much information on their recent improvements on this topic.
- Several participants remarked that the BEMPs would be more relevant if they **focused on access networks** and did not deal with core networks (even if most of the techniques related to dynamic traffic management are also interesting for core networks with the growth of traffic and the increase of the difference between peak and off load).
- Opportunities for reducing the energy consumption at the customers' facilities were identified. Most **end-user devices** typically function at a very low load. Techniques to be considered include implementing dynamic management, replacing existing equipment by new more energy efficient ones, using the energy efficient Ethernet for local connection, monitoring and managing interfaces, etc.
- The **relationship with the EU CoC on broadband equipment** was considered as an important issue since this document contains energy consumption requirements which are continuously updated. It was proposed to use the same approach for BEMPs related to broadband equipment as for the data centres. According to Flavio, a new EU CoC on broadband equipment will be published mid next year. It only includes broadband equipment and not auxiliary products. Furthermore it is not structured in the same way as for data centres with best practices.
- **Network management** of the different parts of the network was identified as an important topic. A large quantity of data is produced, but it can be difficult to identify what is relevant, in order to better control the network (in an automatic way). It could be interesting to propose a method for analysing the data collected (e.g. network analytics), but it was not sure if this was a method already implemented with network operators. A participant mentioned that there are software solutions to predict traffic.
- The current network **'softwarisation' (of hardware and networking functions) and virtualisation** should be addressed since these changes carry important opportunities and risks in terms of energy consumption (e.g. savings

from sharing, but additional energy consumption from applications). Dedicated hardware is more efficient, but software allows flexibility and can lead to greater efficiency.

Applicability:

- Concerning the first BEMP, related to **reengineering wireline networks**, even if the techniques suggested are already being implemented for business reasons, there are still plenty of kilometres of copper cable networks that need to be replaced.
- From the discussion related to **the design and management of wireless networks**, it was thought that there is no need to attempt to propose BEMPs for wireless networks. Wireless networks within companies and BEMPs related to wired networks could however still be considered.
- Proposing relevant best practices faces the **diversity of networks**. It is not very efficient to have multiple generations of cellular networks (e.g. 2G, 3G, etc.) co-existing. The requirement to continue operating old networks is regulated by each country, but it could lead to significant energy savings. Network equipment that operates multiple standards could be a solution.
- Taking advantage of **quality of services requirements** for optimising traffic management is an interesting idea, but that would require changes to customer behaviour. Some participants thought that shifting demand would not be accepted by any user. Participants thought that operators could improve the information provided to customers, e.g. energy labels, showing actual energy consumption, etc., but vendors were not in favour of this. Flavio shared the IEA publication: *More Data, Less Energy: Making Network Standby More Efficient in Billions of Connected Devices (2014)* regarding network standby efficiency.

Cross-media effects:

- The risk of increasing the energy efficiency of the network could lead to significant **rebound effects** as this will increase internet access and demand and in the end lead to greater energy consumption. For example, installing fibre cables to homes increases consumption.
- A participant pointed out that the use of small cells for increasing network coverage **does not lead to increased EMF radiation**.
- If old standards are phased out, then a lot of end-user devices will be obsolete and have to be thrown away.

Indicators:

- The applicability of the indicators proposed for wireless networks was questioned since it is **difficult to measure** the energy consumption in relation to the coverage, the load or the number of customers.
- The **power consumption per base station** was proposed as a relevant indicator for monitoring the energy performance of a wireless network, but it was remarked that it is difficult to compare as this depends on population density and the local environmental conditions.
- Using kWh as a unit was preferred to J.
- Another indicator could be **the power consumption at low traffic load divided by the power consumption at high traffic load**.

XII. DAY 2, SESSION 10: TECHNIQUES TO ADDRESS OTHER ENVIRONMENTAL IMPACTS OF TELECOMMUNICATION AND BROADCASTING INFRASTRUCTURES

EY presented the last two BEMPs related to other direct environmental impacts of telecommunication and broadcasting infrastructure:

- **(BEMP 8.2) Reducing the effects of ICT infrastructures on landscape** intends to reduce the effects of ICT infrastructures on landscape (and biodiversity).
- **(BEMP 8.3) Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks** is about reducing noise and Electromagnetic Field (EMF) emissions through an appropriate location and design and being transparent with the public.

Discussion:

Landscape impact:

- **The relevance of this BEMP was questioned**, since the proposed techniques were considered to depend on local authorities requirements (location, consultation, etc.).
- Several important **cross-media effects** were identified:
  - painting antennas requires material and does not necessarily lead to more acceptance;
  - building a fake tree requires much more materials and equipment;
  - camouflaging an antenna can be perceived as a way of trying to hide health risks;
  - colocation requires larger and stronger structures with a resulting increased impact on the surrounding landscape.
- **Jack** will send specific comments to this BEMP.

Noise and EMF:

- The relevance of electromagnetic radiation was also questioned, since most of the solutions adopted are **driven by public acceptance and local requirements.** It would be challenging to develop a broadly applicable BEMP on this topic. The JRC will consider whether the topic should be acknowledged or not covered at all. It was considered necessary to include due to some stakeholders expecting to find the issue covered in the SRD.
- An example of setting tighter restrictions on electromagnetic radiation in Brussels results in 40% higher energy consumption.
- **Techniques to reduce noise could be proposed**. It was suggested to focus on noise emissions from generators and cooling systems. The BEMPs related to noise and EMF should be separated.
- **Installing antennas in non-accessible sites** was thought to be in the interest of telecommunication operators (i.e. business as usual).
- **Installing antennas on pylons** was identified as a good practice, but considered as not sufficient (since antennas need to be installed were people are located).

- Some participants challenged providing **more information to customers on electromagnetic radiation**, since this can actually lead to increased perception of the negative impacts of telecommunication.
- **Continuous monitoring or sampling of the radiations emitted by equipment** was suggested as a BEMP. Testing for SAR (Specific Absorption Rate) and energy consumption could be a cross-cutting BEMP for all equipment. **Flavio** will provide some information on this practice.
- **Jack** will send specific comments, in order to correct and improve the information on these BEMPs in the Background Report.

XIII. DAY 2, SESSION 11: TECHNIQUES TO IMPROVE THE ENERGY AND ENVIRONMENTAL PERFORMANCE IN OTHER SECTORS

EY presented the last two BEMPs related to:

- **(BEMP 9.3) Provide services to improve the environmental performance of client activities** through environmental performance criteria, take-back programmes, e-invoicing, green cloud services, green software development, etc.);
- **(BEMP 9.4) Provide services to help reducing other sectors' environmental impacts** cover approaches to reduce the environmental impacts of other sectors such as power supply, transportation, manufacturing, buildings and agriculture.

The JRC clarified the aim of this last BEMP is to present success stories and projects that have been already implemented and demonstrated real improvements, and not to speculate about future trends and possible improvements.

Discussion:

Green software:

- Energy-aware software development was recognized as **very promising practice**. For example, the server can tell what platform the client is using and a responsive website can be developed that does not send high quality resolution pictures to mobile phones. It was however acknowledged that green software was not developed enough to be a BEMP. This is due to difficulties in measuring the efficiency of software and to the lack of demand from customers on this issue.
- It was suggested to **move green software to the direct environmental aspects of the telecommunications and ICT services sector section** of the report.
- **Rabih** will send some documents on energy use of mobile applications.
- EY will examine EU H2020 projects on green software. **Niek** mentioned EU funded research from the University of Amsterdam related to green software.

Greening by:

- The JRC reiterated the objectives of the SRD is to target actors in the telecommunications and ICT services sector (and not the end users of telecommunications and ICT services) by presenting real actions with demonstrated **quantitative and impartial results**. The chapter should be built on evidence and not potentials.

- It was suggested to choose few sectors and **introduce case studies** to demonstrate best practices. The importance of **contextualising** the practices was underlined (e.g. video conferencing cannot always replace a physical meeting).
- EY called for **case studies from SMEs in particular and a broad variety of EU Member States**. It would be good to have examples beyond the most well-known big companies.
- **The lack of reliable measurements and assessments of the deployed examples** was pointed out as a limit to describing the best practices.
- The responsibility of ICT organisations in 'greening the world' was questioned, since according to some participants **this demand should come from other sectors** (even if offering greening services is important).
- A remark was made that it was important to distinguish between the instrument (e.g. making ICT more efficient) and the goal (e.g. making the use of ICT more efficient).
- There was a concern about the **'Internet of Things (IoT)' would result in sensors and batteries in millions of products** and these would be forgotten.
- The participants agreed that **the structure and content of the BEMPs in this section should be reviewed**. Different options were proposed:
    - Explaining in the introduction of the report how ICT can be useful and raising awareness of what the sector can do to improve environmental performance in other sectors and society in general.
    - The BEMPs should be descriptive, not prescriptive.
    - Developing a single broad BEMP about how to develop enabling services that help customers and end-users improve their environmental performance and how to promote these. Specific examples could then be added in the report.

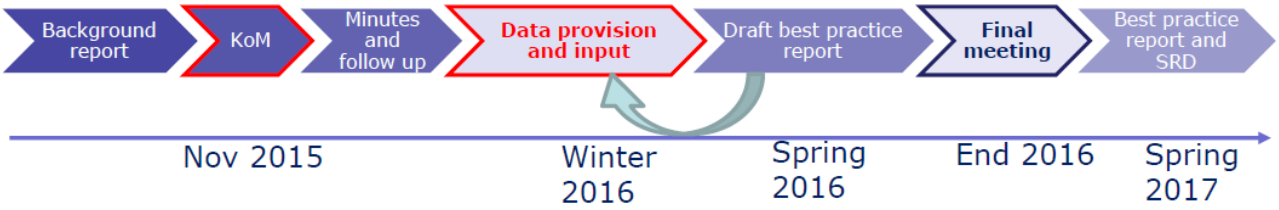
XIV. CONCLUSION

JRC presented their summary of the TWG meeting with the main points that were discussed and agreements reached.

- The participants agreed to the conclusive slides presented by the JRC, which was also shared with all participants after the meeting.

The JRC then explained the key milestones and the next steps in the project.

- The next steps and timeline for developing the SRD is as shown on the figure below:



- The role of the TWG members was explained:
  - Assuring the quality and relevance of the documents related to BEMPs by correcting information and providing precise references and case studies;
  - Sending comments and inputs by end of February 2016;
  - Expanding the network (it is possible to invite other experts).

- A draft of the minutes of the TWG kick-off meeting would be sent around the turn of the year to be reviewed by all participants. A proposal for the new structure of the Background Report will be sent with the minutes for discussion and comments.
- It was agreed that for all further communication and to provide their contributions, TWG members could send their e-mails jointly to the JRC and EY (e-mail should be sent to both jrc-ipts-emas@ec.europa.eu and christophe.abraham@fr.ey.com).

- EY will integrate all the feedback received during the kick-off meeting in the background document, which will be used for the development of the sectoral reference document. EY will over the next few months contact bilaterally members of the TWG for obtaining further inputs, clarification and feedback.
- For the next steps, JRC suggested to organise the work moving forward:
  - by forming sub-groups in order to facilitate exchanges. Participants were encouraged to sign up to sub-groups with a special focus on specific BEMPs. The composition of sub-groups is provided in Annex C.
  - by using e-mails, conference calls and even physical meetings in an informal way - either bilaterally, with sub-groups or with the whole TWG.
- Participants were open to meeting in Seville for the next TWG meeting.

The JRC closed the meeting by thanking all participants for their participation and contributions.

ANNEX A – AGENDA

KICK-OFF MEETING OF THE TECHNICAL WORKING GROUP FOR THE EMAS SECTORAL REFERENCE DOCUMENT ON BEST ENVIRONMENTAL MANAGEMENT PRACTICES FOR THE TELECOMMUNICATIONS AND ICT SERVICES SECTOR

BRUSSELS, 16 - 17 NOVEMBER 2015

FINAL AGENDA – DAY 1

Monday 16th November – 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**
Purpose and goals of the meeting	**10:45 - 11:00**
Introduction of the sectoral reference documents on best environmental management practice (BEMP) and lessons learnt so far	**11:00 - 11:20**
Coffee break	**11:20 - 11:30**
Overview of the Telecommunication and ICT services sector and definition of the scope of the sectoral reference document	**11:30 - 12:15**
Environmental aspects of the telecommunication and ICT services sector	**12:15 - 12:45**
Lunch break	**12:45 - 14:00**
Techniques used in the Telecommunications and ICT services sector to improve the energy performance and minimise the environmental impact of data centres	**14:00 - 15:00**
Techniques used in the Telecommunications and ICT services sector to improve the energy performance of ICT equipment	**15:00 – 16:30**
Coffee break	**16:30 - 16:45**
Cross-cutting measures applied in the Telecommunications and ICT services sector to minimise energy consumption and carbon footprint	**16:45 - 17:30**
Wrap-up and close of the day	**17:30 - 18:00**

FINAL AGENDA – DAY 2

Tuesday 17th November 2015 – Venue: Hotel Crowne Plaza, Rue Gineste 3, Brussels	
Opening of the day	**09:00 - 09:15**
Techniques used in the Telecommunications and ICT services sector to improve raw material consumption and waste management performance	**09:15 - 10:15**
Techniques used in the Telecommunications and ICT services sector to improve the energy performance of telecommunication networks	**10:15 – 11:00**
Coffee Break	**11:00 - 11:30**
Techniques used in the Telecommunications and ICT services sector to address other environmental impacts of telecommunication and broadcast infrastructures	**11:30 - 12:30**
Lunch break	**12:30 – 14:00**
Techniques used in the Telecommunications and ICT services sector to improve the energy and environmental performance in other sectors	**14:00 – 16:00**
Coffee Break	**16:00 - 16:15**
Summary of the working group discussions	**16:15 - 16:45**
Wrap-up and close of workshop	**16:45 - 17:00**

ANNEX B – LIST OF PARTICIPANTS

NAME		ORGANISATION
Christophe	ABRAHAM	Ernst & Young
Mark	ACTON	CBRE Norland
Rabih	BASHROUSH	University of East London
Leo	BAUMANN	NOKIA EU
Ian	BITTERLIN	University of Leeds
Raffaele	BOLLA	University of Genoa
Roel	CASTELEIN	EMEA - The Green Grid
Lex	COORS	Interxion
Stéphane	COURION	CIRB
Bob	CROOKS	Defra, UK - Green ICT Delivery Unit
Flavio	CUCCHIETTI	TELECOM Italia
John	GALLAGHER	Roskilde Universitet
Paolo	GEMMA	Huawei
Andreas	KROEHLING	Deutche Telekom AG
Colm	McDAID	Fujitsu Distinguished Engineer, MIS, Fujitsu UK & Ireland
Billy	McHALLUM	Equinix
Loukia	NIKIFORAKI	LAMDA HELLIX
Jack	ROWLEY	GSMA
Miroslav	SVIEZENY	Qarnot Computing
Adrian	TAN	Ernst & Young
Roger	TIPLEY	Schneider Electric
Alena	TRIFIRO	European Telecommunications Network Operators' Association
Niek	van der PAS	Minkels BV
Kurt	van der HERTEN	IBM
Artemis	VOULKIDIS	Synelixis
Ioannis	ANTONOPOULOS	EC - JRC
Marco	DRI	EC - JRC
Paolo	CANFORA	EC - JRC
Pierre	GAUDILLAT	EC - JRC
Sebastien	PAQUOT	EC - DG ENV
Cristobal	IRAZOQUI	EC - DG CNECT
Paolo	TOSORATTI	EC – DG ENER

ANNEX C – SUB-GROUPS COMPOSITION

Energy consumption in data centres

Mark Acton	Roel Castelein	Billy McHallum	Alena Trifiró
Rabih Bashroush	Lex Coors	Loukia Nikiforaki	Miroslav Sviezeny
Ian Bitterlin	Bob Crooks	André Rouyer	Niek van der Pas
Raffaele Bolla	Paolo Gemma	Roger Tipley	Klaus Verschuere
			Artemis Voulkidis

Environmental performances of ICT equipment

Raffaele Bolla	Paolo Gemma	Colm McDaid	Roger Tipley
Bob Crooks	John Gallagher	Jack Rowley	Alena Trifiró
Flavio Cucchietti	Christophe Garnier		Klaus Verschuere

Cross-cutting measures for minimising energy consumption

Bob Crooks	Paolo Gemma	Jack Rowley	Alena Trifiró
Flavio Cucchietti	Colm McDaid	Roger Tipley	Klaus Verschuere

Waste prevention and management

Bob Crooks	Christophe Garnier	Colm McDaid	Roger Tipley
Flavio Cucchietti	Paolo Gemma	Jack Rowley	Alena Trifiró

Energy performance of networks

Raffaele Bolla	Flavio Cucchietti	Jack Rowley	Alena Trifiró
Stéphane Courion	Paolo Gemma	Hans-Otto Scheck	

Other environmental impacts of telecommunication and broadcast infrastructures

Stéphane Courion	Christophe Garnier	Jack Rowley	Alena Trifiró
Flavio Cucchietti	Paolo Gemma		Klaus Verschuere

Greening by

Roel Castelein
Bob Crooks
Flavio Cucchietti
Colm McDaid
Jack Rowley
Artemis Voulkidis

ANNEX D – PRESENTATIONS

Purposes and goals of the kick-off meeting

Marco Dri

jrc-ipts-emas@ec.europa.eu

Sustainable Production and Consumption Unit

Institute for Prospective Technological Studies (IPTS)

Joint Research Centre (JRC)

European Commission

Environmental Management System (EMS)

An EMS:

- is a tool that provides organisations with a method to systematically manage and improve the environmental aspects of their (production) processes.
- It helps organisations to achieve their environmental obligations and performance goals.

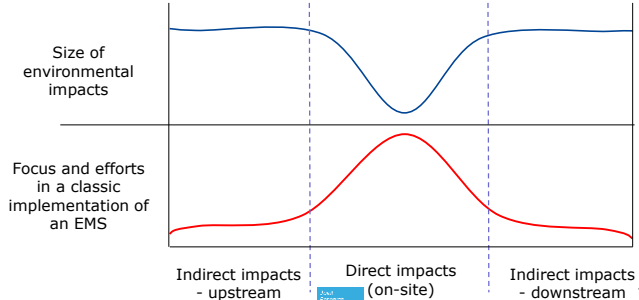
EMAS

EU Eco-Management and Audit Scheme (EMAS) is established by EU regulation (EC) No 1221/2009

EMAS is:

- Open for companies and other organisations;
- A voluntary management tool to evaluate, report and improve the environmental performance;

Need to focus on the most relevant environmental impacts

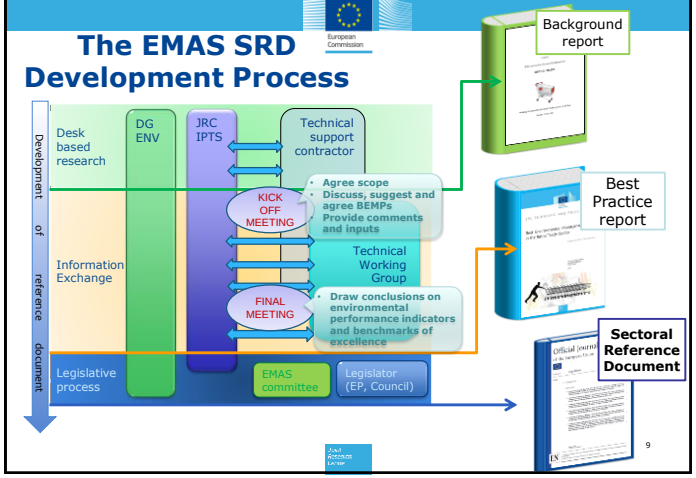


Methodology for developing the SRDs

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 relevant environmental performance indicators for each process;
- Identify frontrunner actors for particular processes;
- Describe best environmental practices with reference to frontrunner application;
- Derive “benchmarks of excellence” from front-runner performance;
- Clearly state applicability.

The EMAS SRD Development Process



Purposes and goals of the meeting

- to know each other
- to exchange views
- to discuss the development of the Sectoral Reference Document (organisation of the information exchange)
- to discuss the timing

Purposes and goals of the meeting

To discuss:

- Scope of the document for the telecommunication and ICT services sector
- Environmental aspects of the telecommunication and ICT services sector
- Proposals for best environmental management practices
- First ideas about environmental performance indicators

Thank you!

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Introduction to the sectoral reference documents and lessons learnt

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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)
  - Food waste minimisation by retailers

- Environmental performance indicators
  - Kg waste generation per m^2 of sales area
- Benchmarks of excellence
  - Zero food waste sent to landfill or incineration plant

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

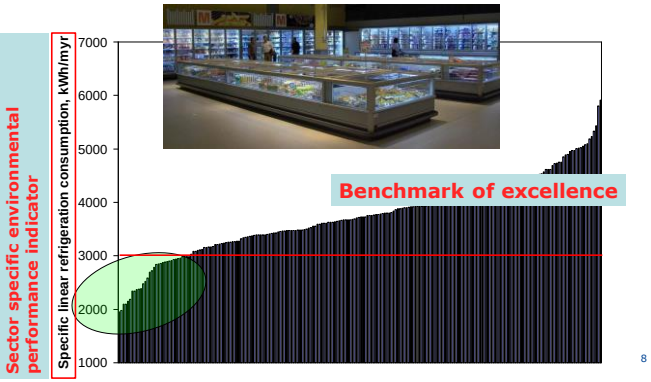
- **Benchmarks of excellence**
  - exemplary environmental performance

very ambitious | achieved by frontrunners | not a target but a measure of what is possible

How to identify BEMPs

The frontrunner approach

An example of BEMP, environmental performance indicator and benchmarks of excellence



Two final outputs for each sector

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

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

Lessons learnt

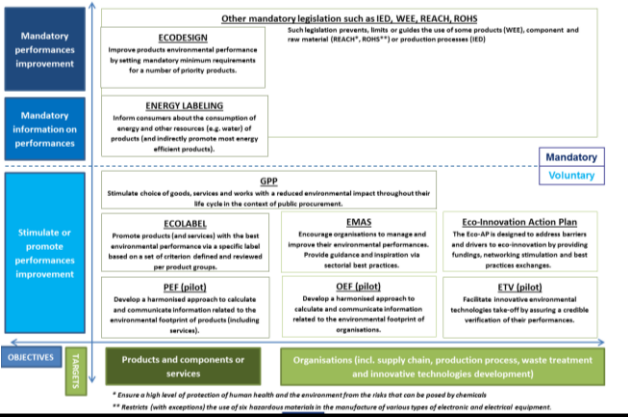
Technical Working Group:

- allows access to a wider network
- constructive and supportive but very different contribution intensities
- composition may change from kick-off to final meeting

Feedback framework

- comments were submitted in an informal way (no template).
- using a template may discourage to send comments

Interaction between EMAS and other policy instruments



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Best Environmental Management Practices for the Telecommunications and the ICT Services Sector

Kick-off meeting of the Technical Working Group for the EMAS Sectoral Reference Document

Brussels, 16 November – 17 November

EY
Building a better working world

European Commission

These slides and the accompanying Background Report was developed by Ernst & Young under contract with the European Commission, Joint Research Centre.

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1. Overview of the Telecommunications and ICT services sector and definition of the scope of the sectoral reference document

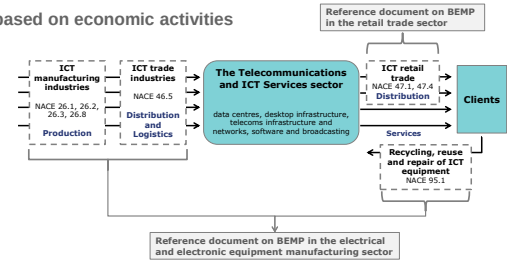
1. Overview of the Telecommunications and ICT services sector and definition of the scope of the sectoral reference document

- **Setting the scope of the SRD:**
  - **Which is the target group?**
    - In principle, companies from the sector
  - **Which are the activities?**
    - The activities are further explained in the following slides
  - **Are other instruments/initiatives in place?**
    - The ICT Code of Conducts (CoC)

Scope of the study in terms of NACE codes / organisations

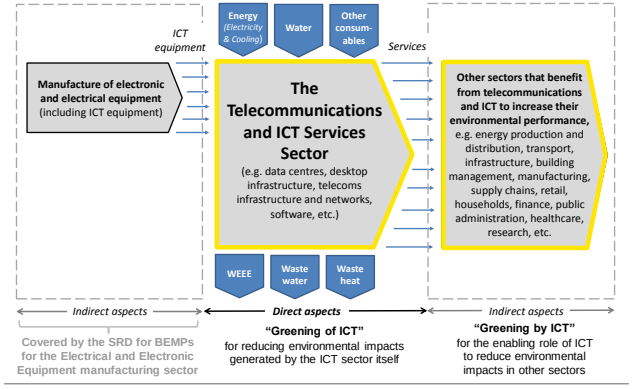
The whole Telecommunication and ICT supply chain is covered by different sectoral documents

Scope based on economic activities



- **Mobility** (business travel and employee commuting) and **tertiary offices** are already developed in the reference document on BEMP in the **Public Administration Sector** (no specific technique related to Telecommunications and ICT Services Sector was identified)

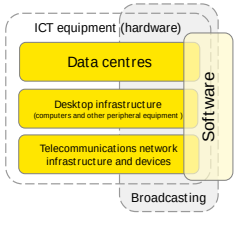
Scope definition in terms of the Telecom and ICT Services value chain



Scope of the study in terms of ICT assets

Scope based on major types of ICT assets

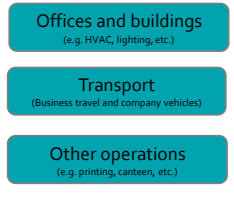
- The scope of the BEMPs for the Telecommunications and ICT Services sector focuses on the following elements which are inter-linked:
  - Data centres (servers, cooling equipment, power systems, etc.)
  - Desktop infrastructure (computers and other peripheral equipment)
  - Telecom infrastructure and networks (base stations, landlines, satellites, etc.)
  - Software (programming, internet websites, applications, etc.)
  - Broadcasting services (radio, television, internet, etc.)



Scope of the study in terms of activities within an organisation

Scope of the study in terms of activities within an organisation belonging to the telecommunication and ICT services sector

- Not included in the scope of the study as considered generic for all companies:
  - **Offices and buildings** (HVAC, lighting, sanitation, etc.)
  - **Transport** (business travel, company vehicles, commuting, etc.)
  - **Other operations** (printing, canteen, etc.)



Scope of the study

The Telecommunications and ICT Services sector covers a wide variety of services

1 Telecommunications
The transmission of voice, data, text, sound and video using electrical signals (both analogue and digital) using wires or cables (wired / fixed) or electro-magnetic waves (wireless / mobile).

2 ICT consultancy
Planning, designing, installing, maintaining and upgrading ICT systems that integrate computer hardware, software and communication technologies and other professional and technical ICT-related activities.

3 Professional use of ICT equipment and infrastructure
The design, construction, operation, maintenance, upgrading and dismantling of ICT infrastructure and networks at local, regional and international level. This includes data processing, hosting and related activities (e.g. data centres).

4 Broadcasting
The distribution of audio, video and/or data content to a dispersed audience (i.e. radio and television) via any electronic mass communications medium such as over-the-air, via satellite, via a cable network or via the Internet.

5 Software development and publishing
The development (e.g. designing, programming, modifying, documenting, testing and bug fixing) and publishing of software products (e.g. operating systems, search engines, applications, databases, web pages, video games, etc.).

Scope of the study

This sectoral reference document focused on specific economic activities (core activities below), **but can also be applicable in other sectors** (activities partially included below)

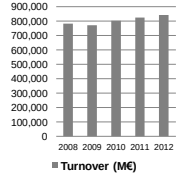
Activities partially included	Core activities	Activities excluded
✓ **Digitalised activities on the Internet** (books and newspaper, broadcasting, news agencies, etc.)	✓ **Telecommunication activities**	✓ **Content and media production**
✓ **Organisation that manage / operate large data storage / processing** (museums and archives, technical testing and analysis, architectural and engineering activities, large corporations, etc.)	✓ **Computer programming, consultancy and related activities**	✓ **ICT devices manufacturing, trade, retail and recovery** (covered by other sectoral reference document)
	✓ **Some information activities** (web portals, data processing and hosting, etc.)	
	✓ **Some publishing activities** (computer games and software)	
	✓ **Reproduction of software**	
	✓ **Installation of mainframe and similar computers**	
	✓ **Activities of call centres**	

Do you agree with this scope?

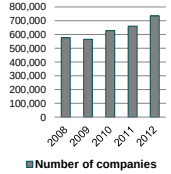
A rapidly growing sector

% of entreprises in the Telecommunication and ICT sector

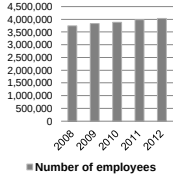
- +150,000 companies between 2008 and 2012
- +2% average growth of turnover over the same period



Turnover (M€)



Number of companies



Number of employees

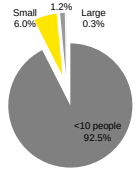
Source: Eurostat 2012, Annual detailed enterprise statistics for services

A rapidly growing sector

The sector is made of a large majority of micro-sized firms

- 92.5% of the 735,000 companies of the sector employ less than 10 people

Distribution of ICT companies by number of employees



Source: Eurostat 2012, Services by employment size class

A rapidly growing sector

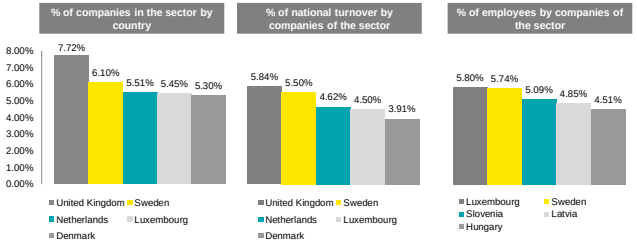
- A few activities account for most of the turnover, number of companies and employees.

	Companies		Turnover		Employees	
	number (2012)		billion EUR (2012)		number (2012)	
58.21 Publishing of computer games	1 257	0.2%	3.56	0.4%	7 400	0.2%
58.29 Other software publishing	18 072	2.4%	19.75	2.2%	120 500	3.4%
61.10 Wired telecommunications activities	11 000	1.5%	155.41	17.1%	360 000	10.2%
61.20 Wireless telecommunications activities	6 027	0.8%	133.82	14.7%	187 000	5.3%
61.30 Satellite telecommunications activities	800	0.1%	9.07	1.0%	20 500	0.6%
61.90 Other telecommunications activities	25 190	3.4%	104.63	11.5%	251 000	7.1%
62.01 Computer programming activities	230 850	30.8%	152.46	16.8%	857 500	24.4%
62.02 Computer consultancy activities	230 644	30.7%	161.39	17.8%	863 000	24.6%
62.03 Computer facilities management activities	20 000	2.7%	33	3.6%	145 000	4.1%
62.09 Other information technology and computer service activities	87 500	11.7%	73	8.0%	360 000	10.2%
63.11 Data processing, hosting and related activities	73 101	9.7%	42.09	4.6%	239 000	6.8%
63.12 Web portals	20 010	2.7%	7.83	0.9%	43 000	1.2%
63.99 Other information service activities n.e.c.	26 000	3.5%	12.1	1.3%	60 000	1.7%
Total	**750 451**	**100%**	**908.11**	**100%**	**3 513 900**	**100%**

Source: Eurostat database 2012

Overview of the sector at a national level

- In several EU countries, the Telecommunications and ICT services sector plays a major economic role



Source: Eurostat 2012 , Annual detailed enterprise statistics for services

EU Eco-Management and Audit Scheme (EMAS)

- 3,000 organisations are EMAS-registered in EU-28
- **42 different organisations and 50 sites** are registered under the NACE codes relevant for the Telecommunications and ICT Services sector

Countries where EMAS-registered sites from the Telecommunications and ICT Services sector are located

2. Environmental aspects of the Telecommunications and ICT services sector

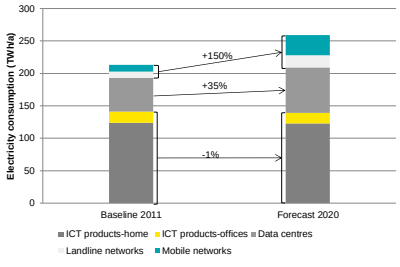
Overview of the environmental issues of the sector

	Main environmental aspects	Main environmental pressures
Data centres	▪ ICT equipment (servers, storage devices, etc.) ▪ Software (processors) ▪ HVAC ▪ Power supply ▪ Buildings	▪ Energy and water consumption ▪ Generation of WEEE and waste water ▪ GHG emissions from electricity production and refrigerant leakages ▪ Land footprint
ICT equipment	▪ ICT equipment (computers, peripheral devices, etc.) ▪ Software	▪ Energy consumption ▪ Generation of WEEE ▪ GHG emissions from electricity production
Telecommunication infrastructure and networks	▪ Buildings (central offices, base stations, etc.) ▪ Nodes (antennas, satellites, routers, etc.) ▪ Links (cables, fibres, landlines, etc.) ▪ Terminals (phones, computers, modems, etc.) ▪ Software (processors, controls, etc.)	▪ Energy consumption ▪ Generation of WEEE ▪ Electromagnetic waves generation ▪ GHG emissions from electricity production ▪ Changes to the landscape and habitats
Broadcasting services	▪ Buildings (base stations) ▪ Transmitters (antennas, satellites, etc. ▪ Links (cables, fibres, etc.) ▪ Terminals (radios, TVs, etc.) ▪ Software (processor)	▪ Energy consumption ▪ Generation of WEEE ▪ Electromagnetic waves generation ▪ GHG emissions from electricity production ▪ Changes to the landscape and habitats

A sector facing increasing environmental pressures

1 Energy consumption and emission of greenhouse gases

- ICT companies (excluding manufacturing and broadcasting) account for 7.7% of CO_2 emissions in the EU (214 TWh)
- This number is expected to reach 8.1% by 2020 (259 TWh)



Source: Öko Institute (2013) Study on the practical application of the new framework methodology for measuring the environmental impact of ICT

The integration of the EU Code of Conduct on data centres energy efficiency

Scope	EU Code of Conduct on data centres energy efficiency	Best Environmental Management Practices for the Telecommunications and the ICT services sector
Environmental pressures	▸ Energy efficiency	▸ Energy efficiency ▸ **Water consumption** ▸ **Landscape integration** ▸ **WEEE prevention and management**
Scope of application	▸ Management of new or existing data centres	▸ Management of new or existing data centres ▸ **Better locating data centres**
Operational information	▸ Technical solutions for energy efficiency	▸ Technical solutions for energy efficiency ▸ **Appropriate environmental indicators** ▸ **Applicability** ▸ **Cross-media effects** ▸ **Economics** ▸ **Driving force for implementation)**

➔ **The CoC used as a tool for the benchmark of excellence**

The integration of the EU Code of Conduct on Energy Consumption of Broadband Equipment

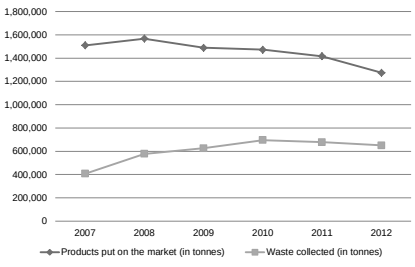
Perimeter	EU Code of Conduct on Energy Consumption of Broadband Equipment	Best Environmental Management Practices for the Telecommunications and the ICT services sector
Environmental pressures	▸ Energy efficiency	▸ Energy efficiency ▸ **Landscape integration** ▸ **WEEE prevention and management** ▸ **EMF**
Scope of application	▸ Access network ▸ End user equipment	▸ Access network ▸ **Core network**
Operational information	▸ Set maximum level of consumption to reach	▸ **Appropriate environmental indicators** ▸ **Applicability** ▸ **Cross-media effects** ▸ **Cconomics** ▸ **Driving force for implementation)**

➔ **The CoC used as a tool for the benchmark of excellence**

A sector facing increasing environmental pressures

2 Raw material consumption and WEEE production

- In 2012, 650,000 tonnes of WEEE were collected (at 89.5% from households) in the EU, while 1,275,000 tonnes of new products were put on the market
- 2/3 of WEEE collected are not appropriately treated despite potentially harmful waste such as lead and cadnium.



Source: Eurostat database 2012

A sector facing increasing environmental pressures

3 Water consumption and wastewater production

- The use of water to cool data centres is an issue in water-stressed regions
- The discharge of warmer water in the natural environmental affects local ecosystems

4 Electromagnetic radiation

- The current levels of EMFs are usually well below the levels identified as damaging
- Public concern and media interest make it a material issue for the sector

5 Changes to landscapes, land use and habitats

- Telephone lines, antennas, dishes, masts, towers and base stations have a visual impact on landscapes
- Low acceptance by local stakeholders can result in complaints and reputational issues

6 Other environmental pressures

- Air pollution (from diesel generators to power base stations)
- Ozone depletion (from leakage of some refrigerants)
- Noise

2. Overview of the proposed BEMP of the telecommunications and ICT services sector

Proposed best environmental management practices

Chapter	Proposed BEMPs
4. BEMP to minimise the energy consumption and the environmental impacts of data centres	4.2. Better locating and planning data centres
	4.3. Optimising data centre utilisation and management
	4.4. Efficient cooling technologies and systems
	4.5. Airflow and settings management and reuse of heat
5. BEMP to improve the energy performance and minimising the environmental impacts of ICT equipment	5.2. Procurement for sustainable equipment
	5.3. Improving the energy efficiency of ICT equipment
6. Cross-cutting measures for minimising energy consumption and carbon footprint	6.2. Use of alternative energy
	6.3. Reducing energy losses due to electricity conversion
	6.4. Energy monitoring and management

Proposed best environmental management practices

Chapter	Proposed BEMPs
7. BEMPs related to raw material consumption and waste management	7.2. Improving waste prevention
	7.3. Improving WEEE collection, recycling and recovery
3. BEMPs to improve the energy performance of telecommunication networks	3.2. Reengineering wired networks for introducing more energy-efficient technologies
	3.3. Designing and managing an energy-aware wireless network architecture
	3.4 Dynamic traffic optimisation through green routing and radio resource management
8. BEMPs related to other environmental impacts of telecommunication and broadcast infrastructures	8.2. Reducing the effects of ICT infrastructures on landscape
	8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks
9. BEMPs related to improving the energy and environmental performance in other sectors	9.3. Provide services to improve the environmental performance of client activities
	9.4. Provide services to help reducing other sectors' environmental impacts

Structure of BEMPs

- For each BEMP identified, we will present the following elements:

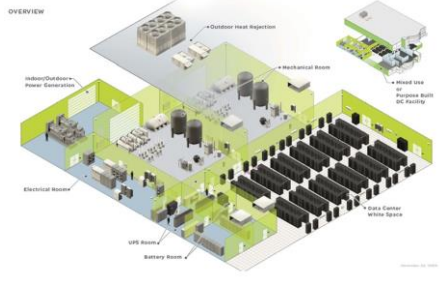
1 Description
Brief description of the BEMP

2 Environmental benefits
Environmental benefits of the BEMP

3 Indicators
Main environmental indicators to monitor the implementation of the BEMP

4 Cross-media effects
Potential cross-media effects, i.e. negative impacts on other environmental pressures due to the implementation of the BEMP

4. BEMPs to minimise the energy consumption and the environ-mental impacts of data centres



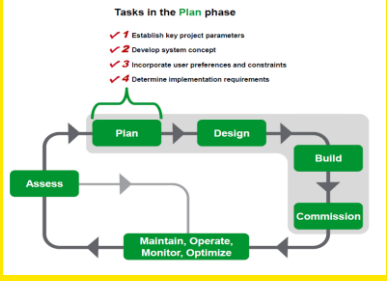
4. BEMPs to minimise the energy consumption and the environmental impacts of data centres

Chapter	Proposed BEMPs
4. BEMP to minimise the energy consumption and the environmental impacts of data centres	4.2. Better locating and planning data centres
	4.3. Optimizing data centre utilisation and management
	4.4. Efficient cooling technologies and systems
	4.5. Airflow and settings management and reuse of heat

Scope

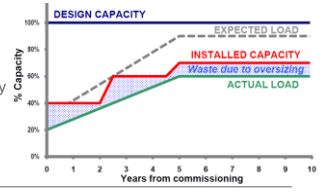
Within the scope of this chapter:	*Developped in other chapters:*
❑ Energy consumption, water consumption, air emissions and landscape pressures	❑ WEEE management
❑ Data centres and server rooms	❑ ICT equipment and networks
❑ Planning, designing, managing and renovating	❑ End-of-life management
❑ Cooling, humidity settings, airflow management, etc.	❑ Power supply and energy management

4.2. Better locating and planning data centres



Description

- **Better locating the data centre**
  - Ambient outdoor temperature and humidity (free cooling, etc.)
  - Potential re-use of waste heat
  - Proximity to a power generating plant (transmission losses)
  - Availability of renewable energy sources (solar exposure, wind potential, etc.)
- **Designing a data centre in an environmental-friendly way**
  - Choice of equipment technology (cooling, UPS, etc.)
  - Procurement for the purchase of energy-efficient IT equipment
  - Definition of equipment installation guidelines
- **Designing modular data centres to avoid oversizing**
  - Optimisation of ICT equipment redundancy
    Continuous adaptation of power and cooling equipment to IT load
    (using modular blocks and phasing the installation of equipment, etc.)

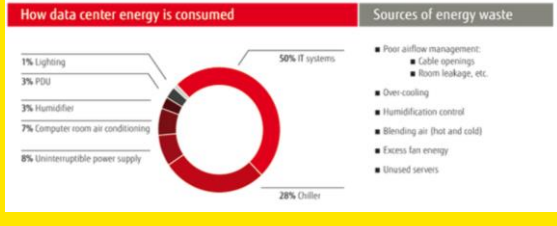


Indicators and environmental benefit

- **Environmental benefits**
  - Indirect energy savings (related to a reduced need for cooling);
  - Indirect reduction in GHG emissions (renewable energy, refrigerant gases);
  - less impact of natural habitats and wildlife

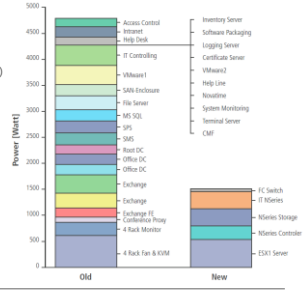
  Quantitative data?
- **Proposed indicators**
  - Power Usage Effectiveness (PUE) / Data Centre Infrastructure Efficiency (DCiE)
  - Land footprint (m²)
- **Cross-media effects**
  - Remote area (longer distance of transportation, more transmission losses, creation of new roads)
  - Risk of building a data centre too small (difficulties when upgrading)

4.3. Optimizing data centre utilisation and management



Description

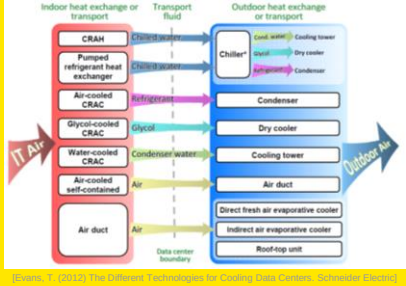
- **Energy-efficient data storage management**
  - Data-reduction technologies:
    - Deduplication software
    - Data compression
    - Automated tiering
  - Storage virtualisation:
    - Thin provisioning
    - Snapshots
    - RAID - Redundant Array of Independent Disks
  - Selecting energy-efficient storage equipment (SSD)
  - MAID - Massive Array of Idle Disks
- **Servers' consolidation**
  - Perform an audit of IT services
  - Decommission unused servers
  - Server consolidation
    - Combine applications onto fewer servers
    - N+1 server clustering
    - Downsize the application portfolio
    - Virtualisation



Indicators and environmental benefit

- **Environmental benefits**
  - reduction of energy consumption (direct electricity consumption from ICT equipment, indirect electricity from cooling and power supply losses)
    - Energy-efficient storage: -50 %
    - Virtualisation : -40 to -80 %
- **Proposed indicators**
  - Server PUE (SPUE) / Server Compute Efficiency (ScE)
  - Deployed Hardware Utilisation Ratio (DH-UR) / Deployed Hardware Utilization Efficiency (DH-UE)
  - IT Equipment Energy Utilization (ITE)
  - Disk space utilisation (%) and server utilisation (%)
- **Cross-media effects**
  - Additional energy consumption with virtualisation (applications, multiplication of servers)

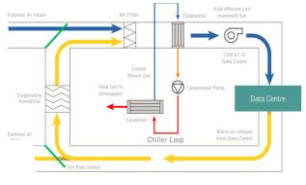
4.4. Efficient cooling technologies and systems

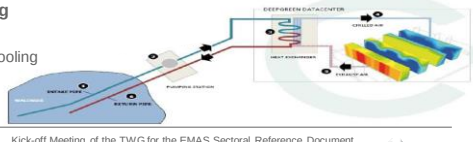


[Evans, T. (2012) The Different Technologies for Cooling Data Centers. Schneider Electric]

Description

- **Centralised air handling** (vs. multiple computer room air handler ((CRAH))
  - Facilitator effect (VSD, air management, free cooling)
  - Scale effect (larger motors and fans)
  - Coordination effect (humidification)
- **Air-side economisers and free cooling**
  - Direct air free cooling
    - "dry air" / "evaporatively conditioned air"
  - Indirect air-side economiser
- **Using water source cooling**
  - Using a lake or a river to dissipate the thermal load of the data centre
- **Direct liquid cooling**
  - Water cooled racks
  - Liquid immersion cooling

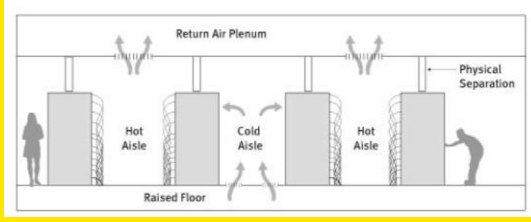




Indicators and environmental benefit

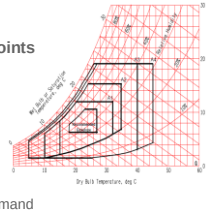
- **Environmental benefits**
  - Direct energy savings
    - Installation of air-side economisers: -60 %
    - Indirect fluid economiser: -70 %
  - Reduction of greenhouse gases emissions
    - Non-utilisation of refrigerants with a large Global Warming-Potential (with free cooling)
- **Proposed indicators**
  - Coefficient of Performance (%)
  - Water Usage Effectiveness (WUE)
  - Free cooling utilisation (number of hours fluid-side economisers are used over a year)
- **Cross-media effects**
  - Direct water consumption (possibility of using rainwater, wastewater or seawater)
    - Use of evaporative chillers
    - Increased need for humidifiers with direct-air economiser
  - Raw material consumption and WEEE generation (renovating an existing data centre)

4.5. Airflow and settings management and reuse of heat



Description

- **Implement cable management**
  - Minimising air flow obstructions (using overhead cabling, removing abandoned cables, etc.)
- **Hot aisles / cold aisles arrangement**
  - Temperature monitoring at rack level
  - Variable speed fans use
- **Aisle separation and containment**
  - Use of blanking panels / cover plates / enclosing panels
  - Segregation of IT equipment / environmental requirement
- **Monitoring temperature and raising temperature set points**
  - Temperature set points meet IT equipment needs (ASHRAE)
  - Increase of inlet temperature if possible
- **Monitoring and widening humidity settings**
  - Humidity range increased
  - Use of adiabatic humidifier / evaporative cooling system
- **Optimising volumes and quality of supplied cooled air**
  - Slight oversupply of air compared to the IT equipment flow demand
- **Heat reuse** (installing a heat recovery system)



Indicators and environmental benefit

- **Environmental benefits**
  - Direct energy savings
    - Blanking panels installation: -1 to -2 %
    - Floor plenum management: -1 to -6 %
    - Hot / cold aisles layout: -5 to -15 %
    - Aisles containment: -5 to -10 %
  - Reduction of waste heat (heat reuse)
- **Proposed indicators**
  - Energy Reuse Effectiveness (ERE)
  - Airflow Efficiency ($W/m^3/hr$)
  - Rack Cooling Index (RCI) / Return Temperature Index (RTI)
- **Cross-media effects**
  - Indirect energy consumption (increase of the server power utilisation)

4. BEMPs to minimise the energy consumption and the environmental impacts of data centres

Proposed BEMPs	Main techniques
4.2. Better locating and planning data centres	❑ Better locating data centres ❑ Designing modular data centres to avoid oversizing
4.3. Optimizing data centre utilisation and management	❑ Energy-efficient data storage management ❑ Servers' consolidation
4.4. Efficient cooling technologies and systems	❑ Centralised air handling (vs. multiple CRAH) ❑ Fluid-side economisers and free cooling ❑ Using water source cooling ❑ Direct liquid cooling
4.5. Airflow and settings management and reuse of heat	❑ Implement cable management ❑ Hot aisles / cold aisles arrangement ❑ Aisle separation and containment ❑ Metering temperature and raising temperature set points ❑ Metering and widening humidity settings ❑ Adjusting volumes and quality of supplied cooled air ❑ Heat reuse (installing a heat recovery system)

Any other BEMPs?

5. BEMPs to improve the energy performance and minimising the environmental impacts of ICT equipment

5. BEMPs to improve the energy performance and minimising the environmental impacts of ICT equipment

Chapter	Proposed BEMPs
5. BEMP to improve the energy performance and minimising the environmental impacts of ICT equipment	5.2. Procurement for sustainable equipment
	5.3. Improving the energy efficiency of ICT equipment

Scope	
Within the scope of this chapter:	*Developped in other chapters:*
❑ Energy efficiency	❑ Waste prevention
❑ ICT equipment	❑ Waste management
❑ Procurement policy	❑ Optimising data centre utilisation
❑ Ecolabels	

5.2. Procurement for sustainable equipment

Description

- The energy efficiency criteria can be considered at each level of the procurement policy:
  - Process preparation: assessment of the existing fleet of ICT equipment and of the needs compared to the different equipment and new technologies available on the market.
  - Call for tender: required environmental criteria to meet.
  - Bid evaluation: environmental criteria must be checked.
- The selection of appropriate equipment:
  - Mobile devices,
  - Appropriately sized options,
  - Appropriate data centres ICT equipment,
  - Multifunction devices to replace several devices,
  - More energy-efficient,
  - Eco-labelled products

Description

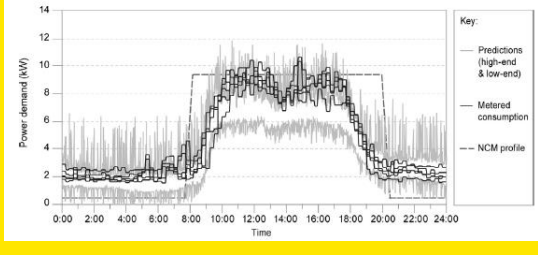
- Ecolabels:

	Energy Star	Blue Angel	Ecolabel	TCO
Label characteristics	In Europe, office computer equipment only	Nearly all office equipment	Computer hardware for individual households, office equipment	Office equipment, supplies, telephones
Consumption in operating mode	Yes	No	Yes	No
Consumption in sleep mode	Yes	Yes	Yes	Yes
Consumption in standby	Yes	Yes	Yes	Partially
Workplace security	No	Yes	Yes	Yes
Noise emissions	No	Yes	Yes	Yes
Mandatory / optional	Optional	Optional	Optional	Optional
Cost of the labelling application	No	Yes	Yes	Yes
Geographic zone of coverage	Worldwide	Germany, also open to foreign producers	Worldwide	Europe and North America

Indicators and environmental benefit

- **Environmental benefits**
  - Direct energy savings
  - Indirect energy savings: reduction of the use of air-conditioning and the associated energy consumption.
  - Reduction of GHG emissions
  - Reduction of water emissions
  - Reduction of toxic and hazardous materials used
  - Reduction of the amount of WEEE generate
- **Proposed indicators**
  - Share (%) of ecolabelled products
- **Cross-media effects**
  - Generation of additional WEEE
  - Rebound effect

5.3. Improving the energy efficiency of ICT equipment



Description

- The energy consumption of an IT device depends on its operating mode. Energy requirements for computers or other peripherals are sometimes ten times greater when turned on compared to standby mode (Buy Smart +, 2012)
- Individual user acceptance: the delays created in the workflow can create a barrier for the acceptance of power management

- **Organisational solutions:**
  - Commitment from the top management: set objectives, can be supported by "champions"
  - Raise employees' awareness: training
  - Evaluation of the needs for specific tasks: audit of the use of ICT equipment
  - Energy monitoring: identify highest consumption and allow for strategic and operational decisions
- **Technical solutions**
  - Manually set up power management: need for on-going education program
  - Automatically set up power management solutions: use of default mode, use of software or smart power strip

Indicators and environmental benefit

- **Environmental benefits**
  - Reduction of annual energy consumption: power management can reduce the energy consumption of devices by 80% (Webber et al, 2006),
  - Reduction of GHG emissions
  - Standby mode and switched off stage :
    - 18% of office workers never switch off their PC at night or during weekends
    - 13% leave it on some nights each week. Equivalent of about 700,000 tonnes of CO_2 emissions (World Economic Forum, 2009)
- **Proposed indicators**
  - Total electricity consumption of ICT equipment
  - Share of staff trained on energy savings
- **Cross-media effects**
  - Generation of additional amount of WEEE
  - Switching mode generates harmonic pollution that can cause problems within power distribution systems

5. BEMPs to improve the energy performance and minimising the environmental impacts of ICT equipment

Proposed BEMPs	Main techniques
5.2. Procurement for sustainable equipment	❑ **Integrating sustainability criteria in the procurement policy** ❑ **Choosing eco-labelled products**
5.3. Improving the energy efficiency of ICT equipment	❑ **Commitment from the top management** ❑ **Energy Champions** ❑ **Trainings** ❑ **Manually set power** ❑ **Automatically set power**

Any other BEMPs?

6. Cross-cutting measures for minimising energy consumption and carbon footprint

6. Cross-cutting measures for minimising energy consumption and carbon footprint

Chapter	Proposed BEMPs
6. Cross-cutting measures for minimising energy consumption and carbon footprint	6.2. Use of alternative energy
	6.3. Reducing energy losses due to electricity conversion
	6.4. Energy monitoring and management

Scope	
Within the scope of this chapter:	*Developped in other chapters:*
❑ Data centre, networks and IT equipment	
❑ Energy efficiency and renewable energy sources	❑ WEEE, EMF emission and landscape impacts
❑ Power equipment	❑ IT and Cooling equipment

6.2. Use of alternative energy

6.2. Use of alternative energy

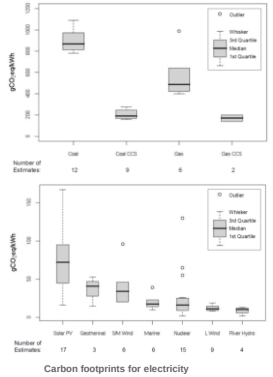
Description

- **Purchasing renewable electricity**
  - Third-party electricity from the grid produced from renewable sources
  - Guarantee of Origin (GO) certificates
- **Producing renewable electricity**
  - On-site / off-site generation
- **Available renewable energy sources for ICT infrastructures**
  - Solar
  - Wind
  - Biomass
  - Geothermal

6.2. Use of alternative energy

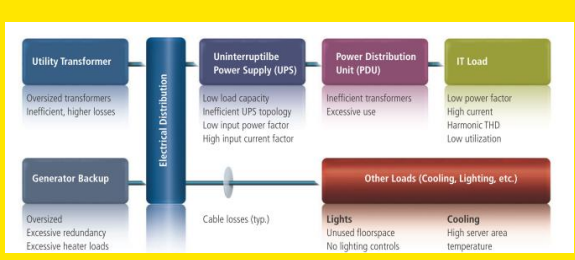
Indicators and environmental benefits

- **Environmental benefits**
  - Decreased CO_2 emissions and air emissions
- **Proposed indicators**
  - Green Energy Coefficient (GEC)
  - Carbon Usage Effectiveness (CUE) (kg CO_2.eq/kWh)
- **Cross-media effects**
  - Land use (PV panels)
  - Forest exploitation (biomass)
  - Social acceptance of wind turbines (noise, visual pollution, impact on wildlife)



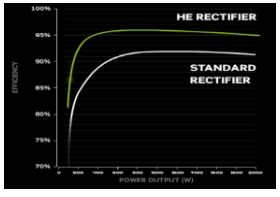
Carbon footprints for electricity

6.3. Reducing energy losses due to electricity conversion



Description

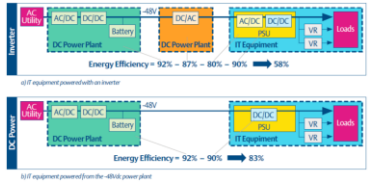
- **Installing a high efficiency UPS**
  - Rectifiers allowing a reduction of energy losses due to electricity conversion
  - Rotary UPS (elimination of battery/inverter approach)



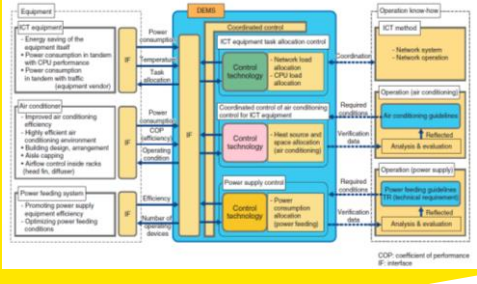
- **Installing modular UPS**
  - Switching units and batteries installed in modular units
- **Choosing the most appropriate UPS solution design**
  - Single unit
  - Cascade/hot-standby
  - Parallel redundant
  - Dual units
- **Running on DC power to reduce the number of conversions**

Indicators and environmental benefits

- **Environmental benefits**
  - Reduction of energy consumption (and CO_2 emissions)
    - when achieving best practices for UPS system efficiency: 4-6%
    - when running on DC power: 7-10%
  - Reduction of waste heat
- **Proposed indicators**
  - UPS Load Factor: average load/load capacity
  - UPS System Efficiency (industry average at 90-92%, best practices at 96%)
- **Cross-media effects**
  - Resources to produce new equipment
  - Generation of WEEE



6.4. Energy monitoring and management



Description

- **Developing measurement capacities**
  - Metering equipment at different levels (facility, room, equipment)
- **Collecting data** (periodic readings)
- **Reporting and analysing data**
  - periodic written reports
  - automated energy reporting console
- **Benchmarking and setting energy efficiency objectives for the facility**

Indicators and environmental benefits

- **Environmental benefits**
  - Reduction of energy consumption
- **Proposed indicators**
  - % of facilities monitored
  - Benchmarking mechanisms implemented (y/n)
- **Cross-media effects**
  - Need for additional monitoring equipment and tools
  - Generation of WEEE

6. Cross-cutting measures for minimising energy consumption and carbon footprint

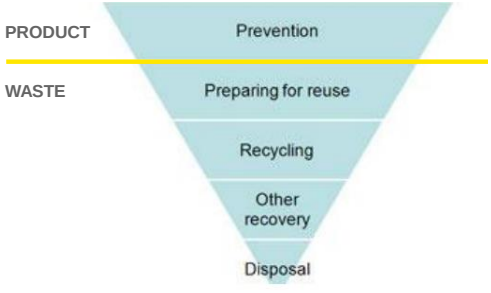
Proposed BEMPs	Main techniques
6.2. Use of alternative energy	❑ Purchasing renewable electricity ❑ Producing renewable electricity
6.3. Reducing energy losses due to electricity conversion	❑ Installing a high efficiency UPS ❑ Installing modular UPS ❑ Choosing the most appropriate UPS solution ❑ Running on DC power to reduce the number of conversions
6.4 Energy monitoring and management	❑ Developing measurement capacities ❑ Collecting data ❑ Reporting and analysing ❑ Benchmarking and setting energy efficiency objectives for the facility

Any other BEMPs?

Proposed best environmental management practices

Chapter	Proposed BEMPs
7. BEMPs related to raw material consumption and waste management	7.2. Improving waste prevention
	7.3. Improving WEEE collection, recycling and recovery
3. BEMPs to improve the energy performance of telecommunication networks	3.2. Reengineering wired networks for introducing more energy-efficient technologies
	3.3. Designing and managing an energy-aware wireless network architecture
	3.4 Dynamic traffic optimisation through green routing and radio resource management
8. BEMPs related to other environmental impacts of telecommunication and broadcast infrastructures	8.2. Reducing the effects of ICT infrastructures on landscape
	8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks
9. BEMPs related to improving the energy and environmental performance in other sectors	9.3. Provide services to improve the environmental performance of client activities
	9.4. Provide services to help reducing other sectors' environmental impacts

7. BEMPs related to raw material consumption and waste management performance

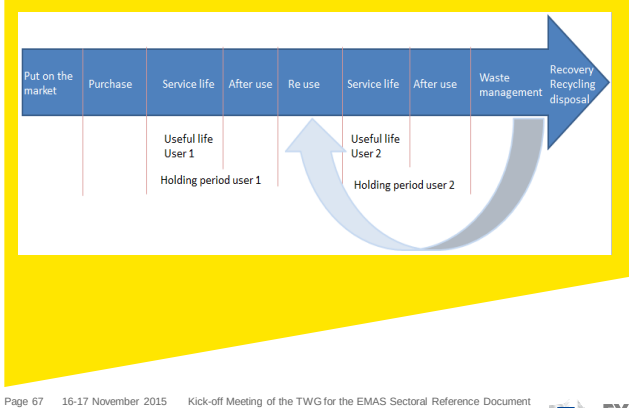


7. BEMPs related to raw material consumption and waste management performance

Chapter	Proposed BEMPs
7. BEMP related to raw material consumption and waste management performance	7.2. Improving waste prevention
	7.3. Improving WEEE collection, recycling and recovery

Scope	
Within the scope of this chapter:	*Developped in other chapters:*
❑ Waste prevention plan	❑ Procurement for sustainable ICT equipment
❑ Waste management	❑ Services to improve the environmental performance of client activities

7.2. Improving waste prevention



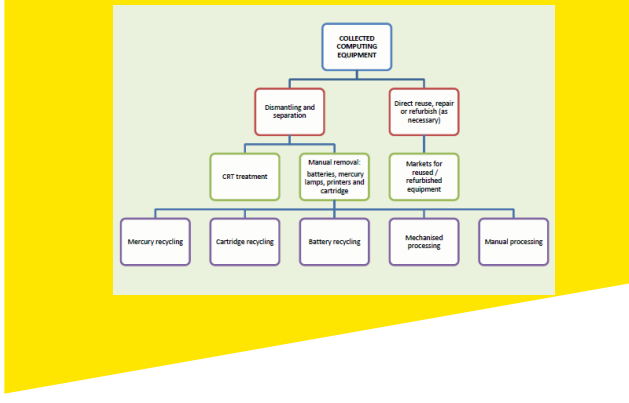
Description

- **Waste prevention plan:**
  - Assessment of the situation to ensure an informed decision making process,
  - Setting priorities and objectives
  - Participative process
  - Based on a LCA of product
  - Ecodesign
  - Asset Lifecycle Management
- **Increasing service life and reduce obsolescence:**
  - Creating compatible complements and substitutes within and between systems and facilitating the replacement and the reuse of products.
  - Promote repair: by manufacturer, suppliers, specialised social companies, independent repairers.
  - Promote services of maintenance.
  - Limit replacement

Indicators and environmental benefits

- **Environmental benefits**
  - 40 to 50% of products were replaced while still being able to function
  - Hazardous substances and natural resources: a mobile phone can contain over 40 substances (UNEP, 2009). The environmental impact of the primary metal production is significant, especially for precious and special metals.
  - CO_2 emissions: to produce 1 t of gold, palladium or platinum, CO_2 emissions of about 10,000 t are emitted.
- **Proposed indicators**
  - Average product life
  - Number of PCs and mobile phones per person
- **Cross-media effects**
  - Using less energy efficient equipment for longer
  - Refurbishment shall not alter the quality of the product for reuse
  - Dependent on the technologies available on the market and on the level on innovation

7.3. Improving WEEE collection, recycling and recovery



Description

- **Objectives:**
  - Maximise the recovery of valuable material resources such as rare metals.
  - Dismantling and removing components.
- **Reverse logistics**
- **Dismantling and segregation**
- **Recycling and recovery**: sorting by types materials, each material will have a specific recycling and recovery process. Cost of recovery to be considered
- **End-of-life management:** ensure that the service provider handles the waste management process properly.

Indicators and environmental benefits

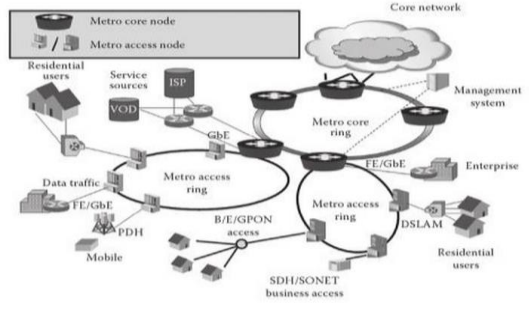
- **Environmental benefits**
  - Reduction of waste and hazardous waste
  - Reduction of GHG emissions linked to the creation of waste
- **Proposed indicators**
  - Total and share of WEEE generated, recovered, recycled and sent to landfill
- **Cross-media effects**
  - Ensure that sensitive data are safely removed
  - Devices sent to developing countries that do not own necessary recycling infrastructures: potential risk that reused product will not be properly disposed at end-of-life

7. BEMPs related to raw material consumption and waste management performance

Proposed BEMPs	Main techniques
7.2. Improving waste prevention	❑ Waste prevention plan ❑ Increasing service life and reduce obsolescence ❑ Reuse ❑ Refurbishment and repair
7.3. Improving WEEE collection, recycling and recovery	❑ Reverse logistic ❑ Dismantling and segregation ❑ Recycling and recovery ❑ End-of-life management

Any other BEMPs?

3. BEMPs to improve the energy performance of telecommunication networks

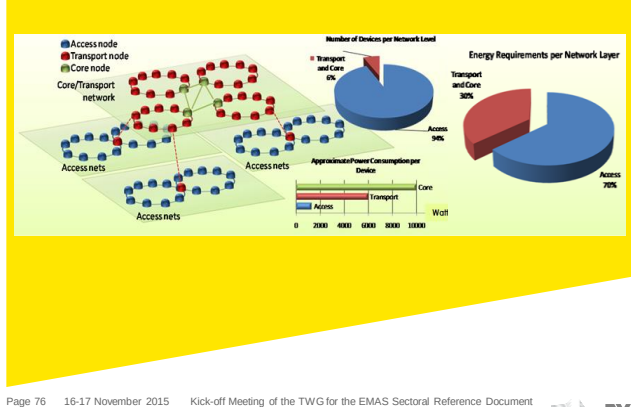


3. BEMPs to improve the energy performance of telecommunication networks

Chapter	Proposed BEMPs
3. BEMP to improve the energy performance of telecommunication networks	3.2. Reengineering wired networks for introducing more energy-efficient technologies
	3.3. Designing and managing an energy-aware wireless network architecture
	3.4 Dynamic traffic optimisation through green routing and radio resource management

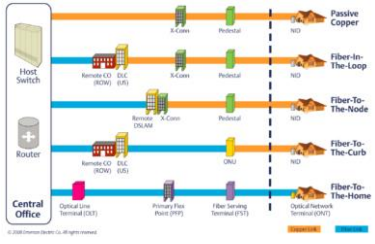
Scope	
Within the scope of this chapter:	*Developped in other chapters:*
❑ Energy efficiency	❑ EMF, landscape and waste
❑ Core, metro and access networks	❑ End-user devices
❑ Telecommunication and broadcast equipment	❑ Cooling and power equipment
❑ Data traffic management	❑ Virtualisation, storage and processing optimisation

3.2. Reengineering wired networks for introducing more energy-efficient technologies



Description

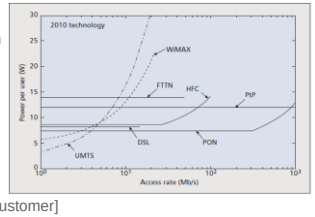
- **Transitioning to an optical access network**
  - Fibre-to-the-Node (FTTN)
  - Fibre-to-the-Home or Point-to-Point (PtP)
- **Reducing the number of active network equipment**
  - Decommissioning unused line and network components
  - Deploying Passive Optical Networks (GPON, Bi-PON, etc.)



- **Installing optical bypass in core networks**
  - Decrease of router capacity and reduced energy losses (O/E/O conversions)
- **Installing more efficient ICT devices** (CoC for Broadband Equipment)
  - Reduced energy consumption (processors, interfaces, cable, etc.)
  - Energy efficient enabling features (low power idle mode, sleep mode, ALR, etc.)

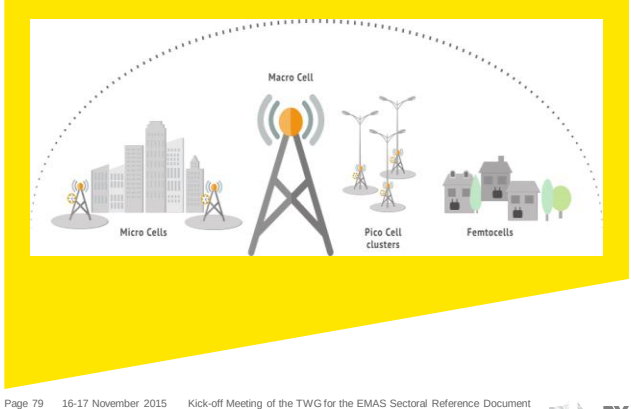
Indicators and environmental benefits

- **Environmental benefits**
  - Direct reduction of energy consumption
    - DSL to FttN: -20%
    - DSL to PON: -80%
    - Optical bypassing: -50%
    - Annual improvement in network equipment: -10 to -20%



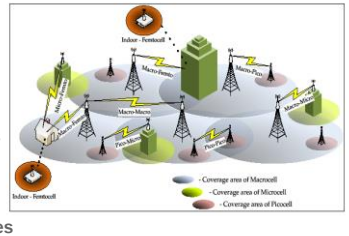
- **Proposed indicators**
  - Power consumption per customer [W/customer]
  - Energy consumed per bit of data transferred [W/bps]
  - % of access network using FTTN / PtP / PON technology
- **Cross-media effects**
  - New network equipment (raw materials and embodied energy)
  - WEEE generation
  - Civil engineering work (noise and dust, landscape and land-use changes)

3.3. Designing and managing an energy-aware wireless network architecture



Description

- **Energy efficient components in base stations**
  - Power Amplifiers (PA): adaptive and more-efficient PA
  - Baseband (BB): Application Specific Instruction Processor (ASIP)
  - Radio Frequency transceivers (RF): CMOS technology
  - Antennas: Remote Radio Heads (RRH) or Active Antenna Systems (AAS)
- **Design an optimal mix of cell sizes**
  - Adaptation to spatial traffic distribution
  - Heterogeneous network (HetNet)
  - Compact base transceiver stations
- **Develop relay nodes schemes**
- **Cooperation between base stations**
  - Coordinated Multi-Point (CoMP)
  - MIMO muting scheme / Smart Antenna Technology

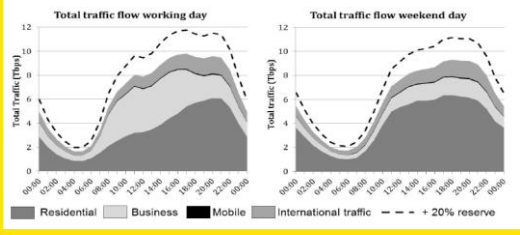


- **Using multi-connection technologies**
  - Multiple Radio-Access Technologies (RATs)

Indicators and environmental benefit

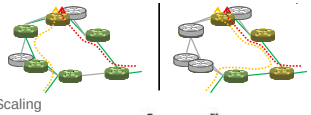
- **Environmental benefits**
  - Direct reduction of energy consumption
    - Heterogeneous Network: -10 to -20%
    - Multi RAT: -5%
    - Relays: -5 to 10%
    - Base station cooperation/coordination: -15 to -25%
- **Proposed indicators**
  - Power consumption per area [W/m²]
  - Area Bit per Joule energy efficiency [bit/J/km²]
  - % of base stations with energy efficient equipment (adaptive PA, ASIP, etc.)
  - % of HetNet (in areas / customers)
- **Cross-media effects**
  - Raw materials and embodied energy (related to new network equipment)
  - WEEE generation
  - EMF increase and landscape impact (related to more antennas)

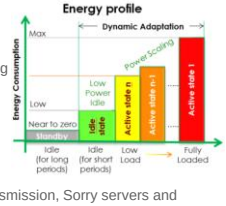
3.4. Dynamic traffic optimisation through green routing and radio resource management



Description

- **Smart standby of network equipment and interfaces**
  - Switching off inactive nodes and links (traffic-aware & coverage-aware software)
  - External proxying
- **Dynamic power scaling**
  - Adaptive Link Rate and Dynamic Voltage Scaling
  - Low Power Idle
- **Dynamic scheduling transmission**
  - Energy-aware packet forwarding and Pipeline forwarding
  - Shaping and Dynamic bandwidth management
- **Dynamic sectorisation of base stations**
  - Cell-size breathing
- **Providing energy-aware services**
  - Quality of Service: Store-Carry-and-Forward (SCF) transmission, Sorry servers and filtering blocs
  - Broadcast distribution: CDN, catch servers, shared services and scheduled distribution





Indicators and environmental benefit

- **Environmental benefits**
  - Direct reduction of energy consumption
    - Smart standby: -25 to -40 %
    - Cell-size breathing: -13 to -30 %
    - Dynamic bandwidth management: -25 %
    - Dynamic scheduling: -20 to -30 %
    - Delay constraints: -20 %
    - Dynamic allocation of users: -10 %
- **Proposed indicators**
  - Power consumption per area [W/m²]
  - Area Bit per Joule energy efficiency [bit/J/km²]
  - Power consumption per customer [W/customer]
  - % of nodes or links switched-off at low traffic loads
  - % of network (in length or traffic) using dynamic traffic optimisation
- **Cross-media effects**
  - Additional energy consumption
    - Processing applications, protocol transmission, performance monitoring, etc.
    - Degrading network performance requires extra network resources

3. BEMPs to improve the energy performance of telecommunication networks

Proposed BEMPs	Main techniques
3.2. Reengineering wired networks for introducing more energy-efficient technologies	❑ Transitioning to an optical access network ❑ Reducing the number of active network equipment ❑ Installing optical bypass in core networks ❑ Installing more efficient ICT devices
3.3. Designing and managing an energy-aware wireless network architecture	❑ Using energy efficient components in base stations ❑ Designing an optimal mix of cell sizes ❑ Developing relay nodes schemes ❑ Enabling cooperation between base stations ❑ Using multi-connection technologies
3.4 Dynamic traffic optimisation through green routing and radio resource management	❑ Smart standby of network equipment and interfaces ❑ Dynamic power scaling ❑ Dynamic scheduling transmission ❑ Dynamic sectorisation of base stations ❑ Providing energy-aware services

Any other BEMPs? ?

8. BEMPs related to other environmental impacts of telecommunication and broadcast infrastructures

8. BEMPs related to other environmental impacts of telecommunication and broadcast infrastructures

Chapter	Proposed BEMPs
8. BEMP related to other environmental impacts of telecommunication and broadcast infrastructures	8.2. Reducing the effects of ICT infrastructures on landscape
	8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks

Scope	
Within the scope of this chapter:	*Developped in other chapters:*
❑ Telecommunication and broadcast equipment	❑ NA
❑ Planning and designing of broadcast equipment	
❑ EMF and landscape	

8.2. Reducing the effects of ICT infrastructures on landscape

Description

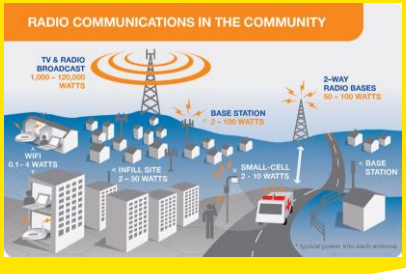
- **Consulting third parties**
  - Identification and consultation during the planning phase
  - Analysis of sitting and appearance
- **Colocation of ICT infrastructures**
  - Sharing of network infrastructure
- **Locating infrastructures close to existing access roads and out of conservation areas**
  - Support of local planning authorities
  - Identification of sensitive location
- **Using existing non-ICT specific infrastructures and camouflage**
  - Keep the equipment in proportion to the building or structure
  - Respect architectural styles
  - Have minimal impact above the roof line
  - Not be detrimental to important views and skylines
  - Avoid creating clutter
  - Use clean lines and maintain symmetry
  - Be painted to correspond with the background or to reduce contrast

Indicators and environmental benefits

- **Environmental benefits**
  - Reduced impact on the fauna and flora around the infrastructure
  - Reduced visual pollution of the landscape
- **Proposed indicators**
  - Height (m) and Surface (m²) (legal requirements)

  Any other appropriate environmental metric / indicators ?
- **Cross-media effects**
  - Camouflage elements necessitate the use of additional resources, including paint, plastic and metals
  - Generation of WEEE

8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks



Description

EMFs

- **Increasing transparency to decrease the concerns of the public**
  - Providing the general public with accessible data on EMF levels
  - Consulting local authorities and population in the planning phase
  - Ensuring that all relevant staff have an adequate awareness of EMF issues
- **Limiting public access to antennas tower locations**
  - Especially on rooftops
- **Following good engineering practice in the siting and installation of directional links**
  - Place antennas at a reasonable distance from living areas

Noise

- **Installing noisy equipment far enough from noise-sensitive areas**
- **Installing noise reducing equipment**

8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks

Indicators and environmental benefits

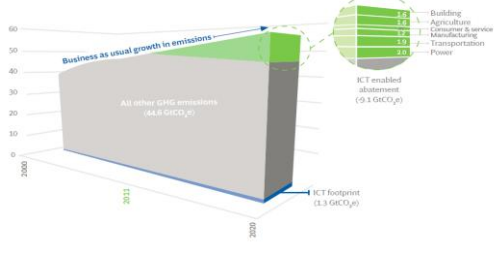
- **Environmental benefits**
  - Decreased exposure of the public
  - Decreased impact of EMF exposure of animals, birds, insects and plants
- **Proposed indicators**
  - EMF emissions per antenna (volt per meter)
  - EMF emissions (in % of recommended emission threshold)
  - Sound emitted by equipment (in dB, compared to the maximum legally authorised sound)
- **Cross-media effects**
  - Potentially increased height of support structures (to decrease EMF exposure at ground level)
  - Increased spacing of antennas might decrease the quality of the coverage and increase exposure of mobile users

8. BEMPs related to other environmental impacts of telecommunication and broadcast infrastructures

Proposed BEMPs	Main techniques
8.2. Reducing the effects of ICT infrastructures on landscape	❑ Consulting third parties ❑ Colocation of ICT infrastructures ❑ Locating infrastructures close to existing access roads and out of conservation area ❑ Using existing non-ICT specific infrastructures and camouflage
8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks	❑ Increasing transparency to decrease the concerns of the public ❑ Limiting public access to antennas tower locations ❑ Following good engineering practice in the siting and installation of directional links ❑ Installing noisy equipment far enough from noise-sensitive areas ❑ Installing noise reducing equipment

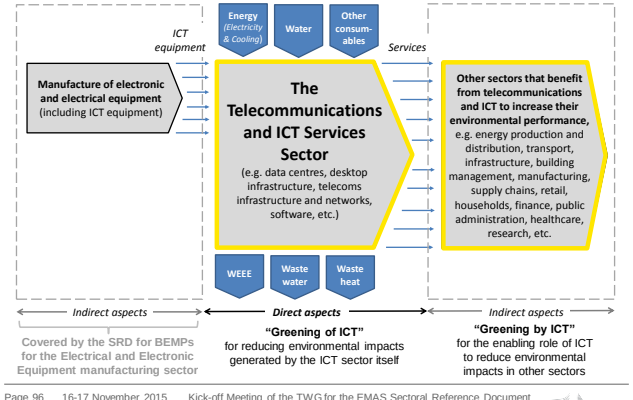
Any other BEMPs?

9. BEMPs related to improving the energy and environmental performance in other sectors



1. Overview of the Telecommunication and ICT services sector and definition of the scope of the sectoral reference document

Scope definition in terms of the Telecom and ICT Services value chain

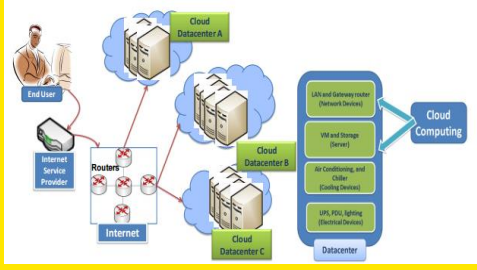


9. BEMPs related to improving the energy and environmental performance in other sectors

Chapter	Proposed BEMPs
9. BEMPs related to improving the energy and environmental performance in other sectors	9.3. Provide services to improve the environmental performance of client activities
	9.4. Provide services to help reducing other sectors' environmental impacts

Scope	
Within the scope of this chapter:	*Developped in other chapters:*
❑ Digitalisation and dematerialisation	❑ Energy efficiency of network
❑ Data collection and communication: real time information	❑ Energy efficiency of data centres
❑ System integration: optimising resources	❑ Energy efficiency of ICT equipment
❑ Process and activity optimisation: automation, simulation and control	❑ Waste management

9.3. Provide services to improve the environmental performance of client activities



Description

- **Establish energy and environmental performance criteria for ICT equipment used by customers:**
  - Eco-rating and ecolabels products: based on the different stage of the life-cycle of the products. Independent third party evaluation: NGOs, international institutions
  - Contracts to improve the useful life of the product
- **Collect and recover used ICT equipment from customers:**
  - Take back programmes: mobile phones and accessories
- **Provide ICT services that reduce commuting and business travel:**
  - Teleworking
  - Audio and videoconferencing services
- **Provide ICT services that reduce paper consumption and consumables:**
  - Online interactive reports
  - E-invoicing
- **Provide ICT services that minimise the energy consumption and environmental impact of managing ICT equipment:**
  - Develop green cloud services: energy efficient applications, network devices and data centres
- **Provide energy efficient software and operating systems**
  - Develop green software: design efficient algorithms, multi-threading software, vectorise the code through single-instruction multiple data.

Indicators and environmental benefits

- **Environmental benefits**
  - Reduce the total amount of WEEE created
  - Reduce energy consumption
  - Reduce GHG emissions: up to 90% of CO_2 emissions reduction through the use of cloud sources.
  - Improve the environmental performance of products
- **Proposed indicators**
  - Total and share of ICT equipment collected from customers, reused, recycled, sent to disposal
  - Avoided GHG emissions
- **Cross-media effects**
  - Ecolabel criteria can create confusion
  - Partnerships and channels for refurbishment, recycling and disposal should be monitored closely to keep track of information
  - Rebound effect

9.4. Provide services to help reducing other sectors' environmental impacts

Description (1/2)

- **Power:**
  - ICT impact: increasing the efficiency and the managing and controlling of power grid through smart grids.
- **Transport:**
  - ICT impact: fleet management systems. New models of transport are integrated in smart cities connected by ICTs.
- **Manufacturing:**
  - ICT impact: Industrial processes are energy-intensive and could be optimised through smart appliances.

Description (1/2)

- **Service and consumption:**
  - ICT impact: transformation of the economy and mode of consumption by influencing consumer behaviour and developing collaborative and shared consumption.
- **Agriculture and land use:**
  - ICT impact: Smart farming and livestock management
- **Buildings:**
  - ICT impact: ICT sector can help the building sector adopting smart building approach integrated in smart cities development.

Indicators and environmental benefits

- **Environmental benefits**
  - Reduce GHG emissions: abatement through the use of ICT in different sectors:
    - Reduce energy consumption
    - Avoid unnecessary commuting
- **Proposed indicators**
  - Reduction of energy used / GHG emissions
  - Reduction of materials used

  Any other appropriate environmental indicators ?
- **Cross-media effects**
  - Protection of private and sensitive data, need to control and safeguard data
  - Depends on the maturity of technologies and networks where the company is located
  - Rebound effects

ICT abatement potential by sector (GeSI, 2012)

9. BEMPs related to improving the energy and environmental performance in other sectors

Proposed BEMPs	Main techniques
9.3. Provide services to improve the environmental performance of client activities	❑ Eco-rating ❑ Take back program ❑ Teleworking ❑ Audio and video conferencing ❑ Online interactive report ❑ E-voicing ❑ Green cloud services ❑ Green software services
9.4. Provide services to help reducing other sectors' environmental impacts	❑ Smart grid ❑ Fleet management and real time information – smart cities ❑ Smart appliances ❑ Changing consumers' behaviour ❑ Smart farming, livestock management ❑ Smart buildings

Any other BEMPs?

Comparison of CoC and proposed BEMPs

EU CoC	Detail
3 Data Centre Utilisation, Management and Planning	❑ 3.1 Involvement of Organisational Groups ❑ 3.2 General Policies ❑ 3.3 Resilience Level and Provisioning
4 IT Equipment and Services	❑ 4.1 Selection and Deployment of New IT Equipment ❑ 4.2 Deployment of New IT Services ❑ 4.3 Management of Existing IT Equipment and Services ❑ 4.4 Data Management
5 Cooling	❑ 5.1 Air Flow Management and Design ❑ 5.2 Cooling Management ❑ 5.3 Temperature and Humidity Settings ❑ 5.4 Cooling Plant ❑ 5.5 Computer Room Air Conditioners ❑ Reuse of Data Centre Waste Heat
6 Data Centre Power Equipment	❑ 6.1 Selection and Deployment of New Power Equipment ❑ 6.2 Management of Existing Power Equipment
7 Other Data Centre Equipment	❑ 7.1 General Practices
8 Data Centre Building	❑ 8.1 Building Physical Layout ❑ 8.2 Building Geographic Location ❑ 8.3 Water sources
9 Monitoring	❑ 9.1 Energy Use and Environmental Measurement ❑ 9.2 Energy Use and Environmental Collection and Logging ❑ 9.3 Energy Use and Environmental Reporting ❑ 9.4 IT Reporting

Proposed BEMPs	Main techniques
4.2. Better locating and planning data centres	❑ Better locating data centres ❑ Designing modular data centres to avoid oversizing
4.3. Optimizing data centre utilisation and management	❑ Energy-efficient data storage management ❑ Servers' consolidation
4.4. Efficient cooling technologies and systems	❑ Centralised air handling (vs. multiple CRAH) ❑ Fluid-side economisers and free cooling ❑ Using water source cooling ❑ Direct liquid cooling
4.5. Airflow and settings management and reuse of heat	❑ Implement cable management ❑ Hot aisles / cold aisles arrangement ❑ Aisle separation and containment ❑ Metering temperature and raising temperature set points ❑ Metering and widening humidity settings ❑ Adjusting volumes and quality of supplied cooled air ❑ Heat reuse
5. ICT equipment	❑ 5.2. Procurement for sustainable equipment ❑ 5.3. Improving the energy efficiency of ICT equipment
6. Cross-cutting measures	❑ 6.2. Use of renewable energy ❑ 6.4. Energy monitoring and management