



Final 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

Ispra (Italy), 17-18 November 2016

These meeting minutes have been drafted by Ernst and Young et Associés as an independent consultant under contract to the European Commission, Joint Research Centre and edited by the European Commission's Joint Research Centre.

For questions on this project, the Joint Research Centre can be contacted at JRC-IPTS-EMAS@ec.europa.eu.

Disclaimer: The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

Table of contents

TABLE OF CONTENTS	2
INTRODUCTION	4
Background	4
Opening of the workshop	5
Purpose and goals of the meeting	5
Introduction of the sectoral reference documents on Best Environmental Management Practices (BEMPs)	5
Structure of the background report and main changes in the report since the kick-off TWG	7
BEST ENVIRONMENTAL PRACTICES: CROSS-CUTTING MEASURES	9
BEMP 2.2 - Making the best use of an environmental management system	9
BEMP 2.3 – Procurement of sustainable ICT products and services	10
BEMP 2.4 – Optimising the energy consumption of end-user devices	11
BEMP 2.5 – Use of renewable and low-carbon energy	12
BEMP 2.6 – Waste management of ICT equipment through waste prevention, reuse and recycling	13
BEST ENVIRONMENTAL PRACTICES: DATA CENTRES	14
BEMP 3.2.2 – Implement an energy management system for data centres	14
BEMP 3.2.3 – Define and implement a data management and storage policy	15
BEMP 3.2.4 – Improve airflow management and design	15
BEMP 3.2.5 – Improve cooling management	16
BEMP 3.2.6 – Review and adjust temperature and humidity settings	16
BEMP 3.3.2 – Selection and deployment of environmental friendly equipment for data centres	17
BEMP 3.4.2 – Developing new ICT services and software minimising resource requirement	18
BEMP 3.5.2 – Planning for new data centres	19
BEMP 3.5.3 – Reuse of data centre waste heat	19
BEMP 3.5.4 – Design of the data centre building and physical layout	20
BEMP 3.5.6 – Selecting the geographical location of the new data centre	20
BEMP 3.5.7 – Use of alternative sources of water	20
BEST ENVIRONMENTAL PRACTICES: TELECOMMUNICATION NETWORKS	21
BEMP 4.2 – Improving the management of existing telecommunication networks	21
BEMP 4.3 – Improving risk management for electromagnetic fields through assessment and transparency of data	22
BEMP 4.4 – Selecting and deploying more energy-efficient telecommunication network equipment	23
BEMP 4.5 – Installing and upgrading telecommunication networks	24

BEMP 4.6 – Reducing the environmental impacts when building or renovating telecommunication networks	24
BEMP 4.7 – Minimising data traffic demand through green software	25
BEST ENVIRONMENTAL PRACTICES: GREENING BY ICT	26
BEMP 5.2 – Digitalisation and dematerialisation	26
BEMP 5.3 – Data collection and communication	27
BEMP 5.4 – System integration	27
BEMP 5.5 – Process activity and functional optimisation	27
ANNEXES	29
Agenda	29
List of participants	30
Recap of information to be provided by experts	31

Introduction

Background

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) Regulation¹. 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>.

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. The JRC also 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. Two meetings of the TWG were held:

- 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 in a draft Background report. Following the kick-off meeting, the draft Background Report was updated to reflect on comments made by participants to the TWG on both structure and content.
- The final meeting was held in Ispra on 17-18 November 2016. The goal of the final meeting was to refine the list of best practises and draw conclusions on environmental performance indicators and benchmarks of excellence. The final version of the background report was sent to the TWG members prior to the workshop.

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>

Opening of the workshop

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

- The meeting agenda was presented and agreed by the participants.
- The TWG members introduced themselves and summarised their experience in the telecommunications and ICT services sector and environmental issues.
- Participants were informed that the meeting would be recorded. There were no objections to this.
- 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.

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.

- 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 are being 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 a finished document and will not be amended anymore. All **comments made by participants to the TWG will be reflected on in the Best Practice Report to be prepared by the JRC.**
- The JRC presented the goal of the TWG final meeting, which is essentially to draw conclusions on environmental performance indicators and benchmarks of excellence. Moreover, the meeting aimed at refining the list of best practises, identify gaps and information needs and obtain feedback and inputs to produce the Best Practice Report.

Introduction of the EMAS Sectoral Reference Documents on Best Environmental Management Practices (BEMPs)

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 SRDs for other sectors.

- **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 (EPIs)**, 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 implementation of common/good practices), was also presented.
- **Benchmarks of excellence** refer to a level of environmental performance that is very ambitious (e.g. top 10 or 20% of the performance of companies in the sector), achieved by frontrunners and measuring what is possible (which is not necessarily a target).

The outputs of the process of defining BEMPs were outlined:

- The **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 EMAS **SRD (Sectoral Reference Document)** is a short synopsis of the best practices, indicators and benchmarks.

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

- EMAS targets organisations (and not products, components or services),
- EMAS is a voluntary scheme (compared to mandatory regulation e.g. EU Eco-design),
- 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).

Discussion

- JRC highlighted the fact that practices from the SRD will be voluntary practices, hence that it will not lead to an over-regulation of the sector.
- It was pointed out by experts that the adoption of environmental friendly practices in some sectors are rarer than in others (for instance regarding software), and it was suggested to include practices economically and technically feasible in the report, even if not fully implemented. JRC answered that if a practice is not implemented, it cannot be considered as a BEMP.
- Experts suggested to change the order of the sections within each BEMP presenting first driving forces for implementation and economic data. JRC

answered that this report should follow the structure adopted in previous reports, but changes in the structure could be adopted in future documents.

- The following remarks from experts pointed out the fact that marketing material is needed (e.g. slides and business cases) for them to act as ambassadors for the SRD, JRC emphasised on the fact that any case study or economic data provided by experts would be highly valuable and would be integrated in the report.
- JRC explained that a pilot was currently run to develop more use-friendly tools through a web-based solution.
- Participants highlighted the fact that indicators should be understandable and related to business in order to reflect progresses. JRC explained that normalised indicators have been selected and that the final meeting of the TWG is useful to assess whether or not these indicators are currently used by companies and allow monitoring their environmental performance.
- Experts pointed out that benchmarks of excellence will need to be refreshed regularly to keep the challenge relevant, especially for this sector that evolves quickly. JRC and EY noted that references to standards and code of conducts in the report are meant to allow flexibility and refreshment of the BEMPs as they evolve.
- It was suggested to identify best performers on a more systematic and scientific way, e.g. by adopting the 2.5% innovators + 13.5% early adopters approach. JRC explained that statistical data shared by companies is very scarce for most BEMPs, which is why the analysis is often done on a qualitative way rather than a quantitative way. While drafting the report, EY made sure that the companies are indeed reaching the performance presented in the Background Report. JRC looks forward to receiving comments on these best performers by the TWG participants.
- Experts advised to be cautious with the EPIs and benchmarks of excellence (BeO) presented in the report, as these might be used by companies to compare with competitors and to promote themselves on potentially unfounded basis. JRC explained that the combination of both process-oriented and outcome-oriented indicators allows to show the performance achieved and the efforts put in by the company to achieve this level of performance. In addition, the Background Report states clearly what environmental indicators and benchmark of excellence are and what they are not (i.e. cannot be used for).

Structure of the background report and main changes in the report since the kick-off TWG

EY presented the structure of the background report:

- The focus of the report is on ICT service and telecommunication activities, and how these activities can benefit other sectors. Activities of manufacturing, retail and waste treatment of ICT devices are not in the scope of this document.
- The report intends to take into account applicability for companies of all sizes, indicating for each practice if it is achievable depending on the size of the company.
- BEMPs are divided into 4 chapters on 1) cross-cutting measures 2) data centres, 3) telecommunications networks 4) greening by ICT.

- There is always at least one BEMP applicable for each life-cycle stage (for the development of a service to the management of end-of-life equipment) and for each type of asset (data centres, telecommunication networks, end-user devices).
- Environmental aspects covered by the background report include energy consumption, GHG emissions and other emissions, resources utilization including water consumption, electro-magnetic fields and other nuisances such as noise, land use and aesthetic.

EY presented the changes made to the report following the kick-off meeting in Brussels in November 2015:

- Several chapters were merged in a “cross cutting measures” chapter.
- The chapter on data centres was re-structured based on the CENELEC technical document on energy efficiency, to which additional practices were added on aspects such as water consumption and land use.
- The chapters on telecommunication networks were merged in a single chapter. New BEMPs were added on the installation of telecommunication sites and on software to reduce data traffic. For harmonisation and intelligibility purposes, it was decided to structure the chapter on telecommunication networks following the same pattern as for data centres (i.e. the structure of the CoC for data centres).
- A Greening by ICT chapter was introduced based on the structure of the SMARTer report.
- Additional information was added throughout the report based on:
 - The feedback from participants to the TWG.
 - Exchanges with experts from the sector.
 - Further research in the existing literature.

Discussion

- JRC explained that the direct environmental impacts of manufacturing ICT equipment have been covered by another sectoral reference document; therefore this one does not deal with issues related to the environmental performance of manufactures of ICT devices. Then it was emphasized to make a consistent and clear link between the report addressing electrical and electronic equipment manufacturers and this report for the telecommunication and ICT services sector. The JRC will share with the TWG the final draft of the best practice report for the electrical and electronic equipment manufacturers when it will be ready at the end of December.
- The environmental issues in terms of climate change adaptation for the telecommunication and ICT services sector was raised by a participant. EY explained that this topic was partially covered by BEMPs referring to the proper localisation of building and infrastructure and by the BEMPs on greening by ICT solutions. However, it was agreed to reinforce this topic whenever possible.

Best environmental practices: cross-cutting measures

BEMP 2.2 - Making the best use of an environmental management system

1) Description of the BEMP

The TWG agreed in general with the description of the BEMP. It was decided to add the dimension of environmental policy at company level in the BEMP (e.g. energy efficiency strategy). This can determine whether or not environmental managers will have the opportunity to implement and develop an efficient environmental management system.

The following changes were agreed by the TWG:

2) Indicators

- (i1): The wording was changed to reflect on the fact that that certification is not enough per se. The indicators now becomes "Implementation of an asset management system, e.g. certified ISO 55001".
- (i2) and (i3): The wording "facilities or sites" and "facilities or operations" will be changed to cover a broader range of organisations, including telecommunication networks operators which can have numerous sites. DG ENV informed the participants that requirements for EMAS registration have been changing and it will be possible to more simply verify organisations constituted by groups or clusters of sites.
- (i5): The indicator was deemed to be too specific and not adapted to the activities of all companies (e.g. measuring the activity of telecommunication networks to normalise energy consumption is a complex issue). Hence it will be replaced by the following indicator: "Use of energy efficiency indicators (Y/N)".
- (i6): The PUE will be removed since this indicator can only be used at facility level (and not at company level).
- (i7): The indicator related to WEEE generation will be reworded to be more positive and to correctly integrate equipment from take-back programmes (otherwise, increasing the number of equipment taken back would increase the quantity of WEEE generated).
- (i8): Participants to the TWG explained that water consumption was linked to a broad range of factors depending on the building and activity of the company (e.g. water consumption is linked to cooling needs/activity in data centres, and to the number of employees in offices). Consequently, it was decided to leave it open for companies to decide which EPI to use for water reporting (e.g. water consumption/IT load for data centres, water consumption/number of employees for other buildings). Hence the indicator is reworded as follows: "Use of water efficiency indicators (Y/N)".
- (i10): The indicator is reworded as follows: "Total carbon emissions compensated (in tCO₂eq)" to include other levers to compensate carbon emissions not only through the Clean Development Mechanism.

- (i9) and (i11): The inclusion of scope 3 emissions was proposed to be included, but was not agreed on because considered by a majority of the participants as not precise nor comparative enough.

No indicator was added to the list, since most of the proposals were referring to specific techniques developed in other BEMPs (e.g. increased consumption or production of renewable electricity, implementation of an energy management systems, or monitoring of energy at server or software level).

3) Benchmark of excellence

- (b1): The wording will be changed in a similar manner as for indicator (i1): “The company has a global and integrated asset management system, e.g. certified ISO 55001”.
- (b2): Similarly as for (b1), the choice to have its EMS verified or not is left to the decision of the organisation. This translates in the following rewording of the indicator: “100% of facilities (to be reworded, see below) implement an advanced environmental management system, e.g. EMAS verified or ISO 14001 certified”.
- (b2) and (b3): “100% of facilities” will be reworded to adapt to the different types of organisations covered in the report.
- (b4): The word “green” will be reworded in the benchmark of excellence, as well as throughout the report. It will be replaced in this benchmark by “renewable”. In addition, the benchmark will be reworded to stress the fact that the first step to reduce carbon neutrality includes a broad range of actions such as the use of renewable energy. Only after these actions have been implemented the company should make use of carbon compensation. Consequently, the benchmark will be reworded as follows: “The company has achieved carbon neutrality (scope 1 and 2), including through the use of renewable energy and carbon compensation, after having pursued all efforts to improve energy efficiency”.

BEMP 2.3 – Procurement of sustainable ICT products and services

1) Description of the BEMP

The following was decided by the TWG:

- The terms “Ensure proper use by end-users” will be reworded into “provides training and guidance to end-users so that they can make the best use of the products”, to highlight the fact that the BEMP goes beyond pure procurement and targets also the use of equipment.
- Participants emphasised on the fact that including environmental criteria in the procurement or other functions requires an environmental strategy at the company’s top level. A link will be made with the description of BEMP 2.2 where the elaboration of such strategy will be developed.
- While the current description focuses on products, experts agreed to also include services.
 - *Patricia will send information on the use of an environmental criteria in a call for tender for a software by the National Dutch Education.*

- The use that can be made of LCA, Total Cost of Ownership (TCO) and Carbon pricing in call for tenders will be further investigated and clarified. Experts stressed the fact that TCO was included in companies' decisions not for environmental reasons but for costs-related reasons.
 - o *Hans-Otto will send information on contracting with economic penalty if energy use is higher than specified by the supplier (energy performance contracts of Nokia).*
 - o *John will send information on a study on procurement of sustainable equipment.*

The following changes were agreed by the TWG:

2) Indicators

- (i1): The word "TCO" (Swedish label) was added to the list of environmental criteria used by companies when procuring products or services.
- (i4): The word "grade" is replaced by "weight" (given to environmental criteria in calls for tenders).
- (i6): The wording will be revised to make the indicator more precise, so that the reader understands that only end-user equipment is targeted here (see comment on description above). It was also suggested to present the eco-passport as a tool that can be used to provide such information.
- An indicator will be added on the integration of Total Cost of Ownership in call for tenders. The following wording was suggested: "Use of Total Cost of Ownership, in call for tenders".

Benchmark of excellence

- (b4): The wording will be changed in a similar manner as for indicator (i4): "weighting" instead of "notation".
- (b5): The wording will be revised to make the indicator more precise in a similar manner as for (i6).
- (b6): A benchmark of excellence will be included 'Use of total cost of ownership in call for tenders' mirroring the new indicator introduced.

BEMP 2.4 – Optimising the energy consumption of end-user devices

1) Description of the BEMP

The following was decided by the TWG:

- The word "end-user" will be clarified, in order to cover both end-users (to be understood as customers) and employees of the company, which are also users.
- The trade-off between device performance and energy use needs to be addressed. For instance, end-users do not necessarily activate the sleeping mode of their devices because the device takes more time to restart. Consequently, even if devices are equipped to reduce energy consumption, the trade-off can lead to users not making use of these functions.
- An expert highlighted the fact to raise awareness of employees not only on power management features, but also on the installation of applications and software on computers since it greatly influences the utilisation of computers.

- It was also suggested to add the aspect of staff training on power management of devices, to include not only professional devices but also personal devices used at workplace (Bring Your Own Device (BYOD) company policy).
- Even if this BEMP already deals with devices provided to customers, the group agreed on the need to make this more explicit. For instance, the optimisation of end-user devices at the customers' place (e.g. set-top boxes) through an appropriate power management configuration during the installation of equipment can be developed.

The following changes were agreed by the TWG:

2) Indicators

- (i1): Because not all employees work on site, the wording will be revised as follows: "Electricity use of offices (kWh) per unit of turnover, number of workstations or number of employees based in that office".
- (i2): Any company in the sector would have GPOs (Group Policy Objects) acting without needing a power management specialist. Consequently, "by a power management specialist" will be replaced by "on installation at optimal power management". It was also suggested to extend this indicator (or to create a similar indicator) to devices installed at customers' places.
- (i3) and (i4): The two indicators on the share of ICT devices audited will be merged into one single indicator. The frequency of audit will be made more flexible. The new wording is as follows: "Share of end-user ICT devices audited on power management at an appropriate frequency (e.g. yearly, only once in the lifetime of the product etc.)".

3) Benchmark of excellence

- (b1): The wording will be changed in a similar manner as for indicator (i2).
- (b2): It was asked to be more specific when mentioning "during their lifetime".

BEMP 2.5 – Use of renewable and low-carbon energy

1) Description of the BEMP

The following was decided by the TWG:

- The description should not focus on specific renewable energy sources, in order to be inclusive.
- Tri-generation should also be covered; it is an interesting energy source as cooling is needed all year long, while heating is not. Co-generation will be excluded since this technique is less appropriate to the needs of telecommunication and ICT facilities that require more cooling than heating supply.
- The description will be made more comprehensive with information on Power Purchase Agreements and on renewable electricity produced in infrastructures funded by the company.
 - *Several members of the TWG will send examples of telecommunication or ICT services companies having achieved 100% energy from renewable*

(and not only 100% electricity from renewables) to support the new formulation of benchmark (b1).

The following changes were agreed by the TWG:

2) Indicators

- (i1): Indicator (i1) will be made more specific by adding a reference to guarantees of origin: “share of renewable electricity purchased (with guarantees of origin) out of the total electricity use (%)”.
- (i3): Following comments sent by experts prior to the TWG, the “Green Energy Coefficient” will be replaced by the “Renewable Energy Factor (REF) according to EN 50 600-4-3”.
- Experts highlighted the fact that not all renewables should be considered equal in terms of emissions. In order to reflect on the different levels of emissions of different energy sources, the following indicator will be added: “Carbon content of the energy used (kgCO₂/energy consumption)”. It was also suggested, if feasible, to normalise this indicator with the carbon content of the local electricity mix.

3) Benchmark of excellence

Upon reception of relevant examples from experts (see last bullet point on description above), it will be decided if the word “electricity” should be replaced by “energy” in benchmark (b1), or if this would be considered too demanding for companies of the sector.

BEMP 2.6 – Waste management of ICT equipment through waste prevention, reuse and recycling

1) Description of the BEMP

The following was decided by the TWG:

- In order to be more inclusive and to better reflect on the content of the chapter, the title could be reworded from “waste management” in “resource efficiency”.
- A cross-reference will be made to the SRD for EEE manufacturers and to the BEMP (2.3) on procurement.
- Management of WEEE by external companies can be further addressed by the BEMP, especially in consideration of the fact that currently WEEE is also exported illegally from the EU to non-OECD countries.
- More information should be provided regarding LCA (based on standard ISO 14040) of different equipment, in order to provide an overview of the environmental impacts of such products (split between different environmental issues and different lifecycle stages) and to give guidance on whether or not it is better to refresh ICT equipment more frequently (e.g. for servers or base stations).
 - *Rabih will provide a study on LCA of servers to JRC, to support the view that refreshing servers every year makes sense from an environmental point of view.*

The following changes were agreed by the TWG:

2) Indicators

- (i1): The wording “facilities or sites” and “facilities or operations” will be changed to cover a broader range of organisations, including telecommunication networks operators. The sentence “or with a certified asset management system” will be moved into a dedicated indicator (see below).
- A new indicator will be added on “the share of facilities or sites (see comment above on wording) with a certified asset management system”.

3) Benchmark of excellence

- A new benchmark will be considered regarding “Zero ICT waste sent to landfill”, based on the examples that participants to the TWG will send.
 - *Participants to the TWG will send examples of companies achieving zero waste sent to landfill (which might for instance be the case of Google).*

Best environmental practices: data centres

The TWG agreed on the following elements, which will be taken into account for all chapters on data centres. All these changes will apply throughout the report. Consequently, they will not be systematically mentioned in the minutes.

- No reference will be made to PUE throughout the report, neither in the indicators nor in the benchmark sections. PUE will be covered indirectly via references made to the Code of Conducts on Data Centre Energy Efficiency.
- Indicators on energy density (e.g. per floor area, per rack, per hour) will be avoided, as they do not provide an accurate estimation of the environmental performance of the data centre.
- The reference to the CENELEC technical document produced on the basis of the EU Code of Conduct on Data Centre Energy Efficiency will be updated, since the final version was published. The new reference is CLC/TR 50600-99-1.
- The sentence “100% facilities” will be replaced by “All data centres” throughout the chapters on data centres to focus only on data centres and not on other facilities.
- The set of indicators referred as KPI DCEM was considered by the participants as complex to calculate and used by only few companies. It was agreed to not make any reference to these indicators in the report, or to refer only to the original ETSI Standard.
 - *Paolo will send the ETSI Standard on KPI DCEM.*

BEMP 3.2.2 – Implement an energy management system for data centres

The changes made to the indicators and benchmark of excellence reflect the elements mentioned in the section above.

Other specific indicators have been proposed (e.g. server utilisation), but were not kept for this BEMP which is quite general.

BEMP 3.2.3 – Define and implement a data management and storage policy

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

1) Description of the BEMP

- The part of the BEMP related to decommissioning of hardware will be completed by information on the decommissioning of virtual machines. LCA has proved that 20% of Virtual Machines could be unused in a typical data centre.
- Experts suggest to go beyond virtualisation and to develop another technique, which is containerization. This will be investigated and included in the best practices report if relevant (i.e. already implemented at full scale by companies and it allows achieving environmental benefits).
 - o *Rabih will send information on containerization.*

Participants recalled that it is particularly important to give accurate information on the applicability of such techniques (e.g. differentiate between enterprise and collocation of data centres).

The following changes were agreed by the TWG:

2) Indicators

- (i1) and (i2): Rack density and SPUE will be replaced by an indicator on dynamic range of servers (i.e. idle server consumption divided by full load consumption).
 - o *Rabih will send information on dynamic range to JRC.*
- A new indicator will be introduced on cabinet utilisation in %.

3) Benchmark of excellence

- (b1) to (b3) will be removed as it is difficult to justify the choice of a specific value that could be considered as benchmark of reference. In addition, regarding virtualisation, experts reminded of the fact that, while it is a good practice to decommission servers, decommissioning virtualised servers is even better. In France, it is estimated that around 20% of virtualised servers are unused.

BEMP 3.2.4 – Improve airflow management and design

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

1) Description of the BEMP

- Experts suggested to make reference to standard EN 50600-2-3.

The following changes were agreed by the TWG:

2) Indicators

- (i1): It was decided to delete the indicator on airflow efficiency,

- (i5): The indicator on rack cooling index will be removed because it is hardly used by the industry.
- 3) Benchmark of excellence
- The benchmark (b1) will be removed to mirror the deletion of indicator (i5).

BEMP 3.2.5 – Improve cooling management

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

1) Description of the BEMP

- It was decided to reword the short description of the BEMP “maintaining cooling system close to its original conditions” to “maintain cooling system in optimum conditions depending on IT load requirements”. In fact, if the ICT load changes, the cooling will need to be adapted accordingly.
- It was also required to better explain the trade-off between water usage and energy use (WUE vs PUE) in relation with the description of the water usage effectiveness (WUE).

2) Indicators

The following changes were agreed by the TWG:

- (i1): Because it is very complex to measure the COP of equipment (a lot of measurement devices are required to carry out a proper measurement), it was decided to use the COP given by the manufacturer. The indicator now becomes “COP (coefficient of performance) as given by the manufacturer”.
- (i4): CUE was deemed to be still work in progress and to lack standardisation (unlike PUE and WUE). Consequently, the indicator should be removed.

3) Benchmark of excellence

- The benchmark (b1) will be reworded to mirror the change of indicator (i1), as follows: “Select equipment with COP 7 or higher...”.

BEMP 3.2.6 – Review and adjust temperature and humidity settings

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

1) Description of the BEMP

- It was suggested to make a reference in the BEMP to the ETSI standard 300 019-1-3 class 3.1 on Environmental conditions and environmental tests for telecommunications equipment. Proximus already applies the standard to allow temperature to raise exceptionally up to 55 degrees
- This BEMP is one of the best practices in the Code of Conduct on Data Centre Energy Efficiency. In the CoC and no reference is made to the ETSI standard, but only to ASHRAE. .
- The BEMP should mention in the applicability the need of having an holistic approach for all the system when adjusting temperature and humidity

- Experts agreed that the term “free cooling” should be used in the report instead of “economizer”, which is the American word for “free cooling”.

The following changes were agreed by the TWG:

2) Indicators

- Similarly to BEMP 3.2.4, it was decided to remove the indicator (i1) on airflow efficiency.

3) Benchmark of excellence

- The benchmark (b1) will be reworded to mirror the change of the indicator (i1), as follows: “Select equipment with COP 7 or higher...”.

BEMP 3.3.2 – Selection and deployment of environmental friendly equipment for data centres

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

1) Description of the BEMP

- The title of the BEMP should be changed, from “green equipment” to “environmental friendly equipment”.
- "Open compute" architecture can support the deployment of efficient data centres. This aspect could be included in the text of the BEMP.
- Regarding UPS, it was suggested to make reference to the code of conduct on UPS and to the Standard ETSI TS 102 121 V1.3.1 (2014-07) which defines the energy performance of UPS.
- The description part related to the upgrading of cooling equipment should mention blank panels and control fans as recommended equipment. This items are covered among the best practices of the Code of Conduct on Data Centre Energy Efficiency.
- Experts highlighted the importance of checking how all types of equipment (ICT, power supply, etc.) work together, besides the specific characteristics of each type of equipment.
- The potential rebound effects when different pieces of equipment do not work well with each other should be considered. JRC will look in the CoC to see if this element is covered.

The following changes were agreed by the TWG:

2) Indicators

- It was decided that an indicator on design PUE can be added (based on standard EN 50600-4-2). Design PUE requires a capacity assessment of what can be expected from the data centre, and allows to understand where the data centre will be losing energy.

- *Rabih will send documents on right sizing and on the average equipment age (developed in the ERURECA project), which could potentially lead to the inclusion of two additional EPIs.*

3) Benchmark of excellence

- (b3): Because a UPS efficiency of 97% can only be reached using specific techniques in a limited number of data centres (e.g. only in data centres with a UPS above 1,000 kWh), it was decided to reword the benchmark as follows: “UPS meet the requirements of the EU Code of Conduct for UPS”.
- (b4): Similarly to section 3.2.5, the benchmark will be reworded as follows: “The COP given by the manufacturer is 7 or higher...”.

BEMP 3.4.2 – Developing new ICT services and software minimising resource requirement

General comments on the data centre chapters apply (see section 'best environmental practices: data centres'). See also comments on BEMP 4.7 and the possibility to merge all software practices in one single BEMP (cross-cutting measure).

1) Description of the BEMP

- The title of the BEMP will be rephrased from “minimising servers utilisation” to “minimising resource requirements”, in order to be less specific.
- The relevance of the BEMP was questioned due to the fact that data centre operators can have little influence on software, which belong to the customer or to someone else in the company. However, there are cases of software developers, business owners and data centre operators working together. Because the chapter was developed according to the Code of Conduct on Data Centre Energy Efficiency, it was decided to keep this BEMP.
 - *Rabih will share examples of software developers, business owners and data centre operators working together.*
- The existence of a potential trade-off between software environmental performance and usability/performance (e.g. redundancy can be needed in some cases) was discussed by participants. A trade-off analysis could be a useful tool to support choices.
 - *Rabih will send information on the trade-off and Thomas will provide counter arguments.*

The following changes were agreed by the TWG:

2) Indicators

- A new indicator will be introduced: “Share of software monitored for energy use”.
- A new indicator will be introduced: “Share of software developers (staff) trained on energy efficient software”.
 - *Rabih will send examples of frontrunners in workload management solutions to potentially include an additional indicator on this topic.*

The existing indicators will be reworded as follows:

- (i1) and (i2): Experts suggested to harmonise the wording between “energy performance” and “energy consumption”.
 - (i3): The indicator will be completed by mentioning code reviews in addition to refactoring, as follows: “which have been refactored or which have undergone code reviews”. Besides, the terms “developed software” need to be revised in order to better take into account that most of the time software are not new but only upgraded.
 - (i4): The relevance of providing a share in % will need to be further investigated, and the wording “assessed” will be revised in order to be less specific (“assessed or monitored” for instance).
- 3) Benchmark of excellence
- It was suggested to include a new benchmark on “training of staff on energy efficiency of the software” to mirror the creation of a new indicator (see above).
 - o *Patricia will provide information on (b2) and more generally on the BEMP.*

BEMP 3.5.2 – Planning for new data centres

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

- 1) Description of the BEMP
- Experts drew the attention on the fact that multi-path infrastructures may be environmentally relevant in some case.
- 2) Indicators
- Experts agreed to replace the indicator (i2) on PUE by an indicator on design PUE (see 3.3.2).
- 3) Benchmark of excellence
- The benchmark of excellence proposed in the background report was agreed upon by the TWG.

BEMP 3.5.3 – Reuse of data centre waste heat

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

- 1) Description of the BEMP
- Experts discussed the relevance of this BEMP as energy reuse might not be feasible by data centres where no customers purchase the waste heat produced. Hence, putting it as a metric would suggest that all sites would need to implement this, which could be inappropriate. Because this practice is included in the Code of Conduct on Data Centre Energy Efficiency, it was decided to keep it in the report, however its limitations to applicability should be strengthened in the text.
- 2) Indicators

- (i1) will be reworded as 'Energy Reuse Effectiveness (ERE) = (Total energy – Reused Energy) / IT energy'
 - (i2) will be reworded as 'Energy Reuse Factor (ERF) = Reused energy / Total energy'
- 3) Benchmark of excellence
- The benchmark of excellence proposed in the background report was agreed by the TWG.

BEMP 3.5.4 – Design of the data centre building and physical layout

The BEMP proposed in the background report was agreed upon by the TWG.

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

BEMP 3.5.5 – Selecting the geographical location of the new data centre

General comments on the data centre chapters apply (see 3.2.2).

1) Description of the BEMP

The following elements were discussed:

- It was suggested to mention in the description that brownfields should be preferred over greenfields when selecting the location of the data centre.
- The reference to flooding should be removed from the short description of the BEMP, as it seems to indicate that we focus on flooding in particular. Removing it makes the short description more balanced.

2) Indicators

- (i1) and (i2): Experts agreed on the fact that the parts in bracket (i.e. 'air-side economisers, geothermal cooling, etc.') should be removed in order to make both indicators inclusive, i.e. not limiting them to a specific range of renewable energy sources.
- (i1), (i2) and (i3) should refer to 'data centres' instead of 'facilities'

3) Benchmark of excellence

- The benchmark of excellence proposed in the background report was agreed by the TWG.

BEMP 3.5.6 – Use of alternative sources of water

General comments on the data centre chapters apply (see section 'best environmental practices: data centres').

1) Description of the BEMP

- No additional comment on the description.

2) Indicators

- (i2): The indicator focuses on other consumption than IT loads (as reference is made to m² of data centre). Consequently, its relevance is limited for data centres and should be removed.
 - WUE (i3) will be kept.
- 3) Benchmark of excellence
- The benchmark of excellence proposed in the background report was agreed by the TWG.

Best environmental practices: telecommunication networks

BEMP 4.2 – Improving the management of existing telecommunication networks

1) Description of the BEMP

TWG experts discussed the following elements:

- JRC will make sure that wired networks are covered throughout the BEMP (for instance in indicator (i3)).
- The wording of the first bullet point of the short description should be reviewed (“measure the energy consumption of network elements by using smart energy meters and automated analysis”) and the changes reflected in the text of the BEMP. “Using smart energy meters” will be removed to leave it open for companies to decide how they measure energy consumption (e.g. thanks to estimates). It will be made clearer that “elements” are not only devices but also functionalities.
 - o *Raffaele and other expert will send information on this topic.*
- It will be explained in the description of the BEMP that energy consumption estimations can be made by companies in order to monitor energy consumption. If the company has reference cases that allow for estimating energy consumption, there is no need for measuring the energy consumption of all the company’s sites. For instance, 10.000 sites out of 55.000 Telecom Italia’s sites account for 50% of the energy consumption of the company. It makes sense to monitor the consumption of these sites and to estimate the consumption of the other sites.
 - o *TWG will share information on monitoring energy consumption and estimations.*
- It was suggested to investigate the possibility of adding to this BEMP information on “energy driven dynamic scheduling”.
 - o *Patricia will send information on energy driven dynamic scheduling (among other things to see if it is only an EU project or if it has been implemented by companies).*
- Even if this BEMP is focusing on energy management, capacity planning and forecast demand elements should be included in this BEMP or in another BEMP (e.g. BEMP 4.6 on building and renovating networks) since it has a great influence on the energy performance of the telecommunication network.

- It was also suggested to refer to energy management systems for telecommunication networks in the description.

2) Indicators

The following changes to the indicators were decided by the TWG:

- (i1): “power consumption per customer” will be reworded into “Average energy consumption per customer or subscriber” to be more feasible.
- (i3): The wording of the indicator will be amended to cover both mobile and fixed lines (“Mobile or fixed network data energy efficiency”).
- (i4): The indicator is not applicable (only dictated by network traffic) and will be removed.
- (i5): If (b1) is kept in the report, then (i5) will be reworded to better match with the benchmark of excellence as follows: “Share of network energy usage for which energy consumption is measured”.

3) Benchmark of excellence

The TWG discussed the following elements:

- (b1): The benchmark will be amended as described in the description section, i.e. “Using smart energy meters” will be removed to leave it open for companies to decide how they measure energy consumption.
 - *TWG experts will send information on the percentage of energy usage monitoring that is achieved by frontrunners.*
- Experts discussed the possibility to add a further benchmark of excellence “Have an energy management system in place for telecommunication networks” based on the information sent to the JRC by the TWG.
 - *Daniel will send information on the implementation of an energy management system by Telefonica.*

BEMP 4.3 – Improving risk management for electromagnetic fields through assessment and transparency of data

◦

1) Description of the BEMP

TWG experts discussed the following elements:

- The experts highly recommended to focus more on environmental issues than on health perception from customers.
- The BEMP could also cover EMFs from mobile phones, as it is done by several companies such as Telecom Italia, Orange, O2, Telefonica and Proximus.
 - *Flavio will share information on the measurement of Specific Absorption Rate (SAR) of mobile devices.*
- The use of the word “radiation” will be avoided, and replaced by “emissions of EMFs” all long the report.
- Experts required to make more reference to the ITU works on this topic.
 - *Paolo G. will send an ITU report on how to inform the public.*

2) Indicators

The following change in indicator was decided by the TWG:

- (i1): The indicator will be reworded as follow: "Percentage of sites assessed by measurement for compliance with EMF limits" or "percentage of sites regularly or continuously monitored (also with a software) for compliance with EMF limits'. The JRC will circulate a proposal to keep one of the two or both indicators.
 - (i2): The indicator will be removed as it is not directly linked to companies' environmental impact.
 - A new indicator could be added on the "percentage of sites regularly or continuously monitored for compliance".
- 3) Benchmark of excellence
- A new benchmark defined as "100% of measurements below EMF legal limits" was discussed but it was decided not to keep it.

BEMP 4.4 – Selecting and deploying more energy-efficient telecommunication network equipment

- 1) Description of the BEMP
- Experts suggested that the words "base stations" will be replaced by "sites" in order to be more inclusive.
 - It was explained that virtualisation or functionality centralisation were not always best practices for minimising the energy consumption of networks. More information on the applicability of such techniques is needed.
 - Beyond focusing on free cooling techniques, the experts suggested that the report should refer in general also to all non-mechanical cooling solutions.
- The following changes were agreed by the TWG:
- 2) Indicators
- (i2): The indicator will be reworded with the terms "where applicable" to reflect on the fact that not all sites can implement this practice: "Share of sites with multi-standard solutions where applicable".
 - (i3): The indicator will be reworded as follows: "Average power/energy stations energy efficiency" since there is no UPS in telecommunication sites.
 - A number of indicators could be added to the BEMP:
 - o "Percentage of base stations equipped with hardware compliant with ETSI standard".
 - o "the temperature is set at the maximum allowable according to the equipment on site". This makes sense because not all sites need cooling, and because operators often set temperature at 20 degrees, although modern equipment can work at 40 degrees or more.
 - o "Percentage of sites with not only mechanical cooling".
 - o "Percentage of equipment able to deliver dynamic management".
- 3) Benchmark of excellence
- (b2): The wording and target of the benchmark will be changed as follows: "Energy efficiency of power/energy stations is 96% or higher".

- (b...): A new indicator could be added to mirror the benchmark used in the data centre chapter (see 3.2.5): "Select equipment with COP 7 or higher...".

BEMP 4.5 – Installing and upgrading telecommunication networks

1) Description of the BEMP

- Experts suggested completing the description of the BEMP with references also to wireline networks, in addition to mobile networks. The short description of the BEMP could be reworded e.g. as follows: "deploying 4G technology in existing base stations or full broadband equipment on wireline sites".
- It was recommended to make reference not only to the decommissioning of ICT equipment, but also of cooling and other types of equipment. Moreover, decommissioning and upgrading equipment in central offices could also be relevant for the BEMP.
- Participants highlighted the fact that having a plan for decommissioning and to coordinate the different companies that intervene on site is necessary to really optimise the energy performance of telecommunication sites.

2) Indicators

The following elements were discussed by the TWG:

- (i1) and (i2): A footnote will be added to stress the fact that these indicators are for mobile networks, because an equivalent metric for wireline has not yet been standardised. An indicator will be added to cover wireline networks: "ICT energy use/total energy use of the network".
- (i3): The indicator will be removed, as the lifetime of ICT equipment is in contrast with previous indicators encouraging the refreshment of equipment.
- (i4): The indicator will be reworded as follows: "Quantity of unused or inefficient equipment decommissioned and removed during the year". The reference to ICT equipment in particular will be removed, in order to cover also cooling equipment. Moreover, in general it was suggested to clarify in the text of the BEMP that the wording "decommissioning" should refer to both unused and inefficient equipment..

3) Benchmark of excellence

- It was decided to add a reference to the inefficiency of equipment in the benchmark (instead of its obsolescence) as follows: "...to remove unused or inefficient equipment...".

BEMP 4.6 – Reducing the environmental impacts when building or renovating telecommunication networks

1) Description of the BEMP

The following was discussed by TWG participants:

- The BEMP should also cover environmental impacts from construction works (footprint, noise, dust, resource consumption, energy consumption, etc.).

Theodoros will send information on low environmental impact construction techniques for wired telecommunication networks.

- The EU Noise Directive and its obligation to check noise should be mentioned in the description of this BEMP.
- Experts suggested mentioning that some of the practices are applicable in rural areas only (e.g. the location of network infrastructures close to existing access roads and out of conservation areas") and some others are more relevant for urban areas (e.g. installation of noise reducing barriers in street cabinets). The description should also mention the fact that in some areas (especially rural and conservation areas), people are in demand of more network coverage.
- The description should also make the distinction between the types of infrastructure that can be shared (e.g. companies can share a pylon, a pipe for cables, a piece of equipment) or the types of sites that can be collocated (e.g. applicable to fixed networks and not only to wireless networks).
- A cross-reference with the BEMP 2.5 on the generation of renewable energy will be introduced.

2) Indicators

The following elements were discussed by the TWG:

- (i1): As explained further in (b1) below, the relevance of this indicator ("percentage of sites shared with other operators") will be checked.
- (i2) and (i3) will be removed and the creation of a new indicator related to noise issues will be considered by JRC. The proposal will be sent to the TWG for approval.
- It was decided to include an indicator on the use of existing infrastructures when building new wireline networks.

3) Benchmark of excellence

- For benchmark (b1), it was suggested to check the applicability of colocation in certain countries, as colocation might be forbidden or limited by law.
 - o *JRC will contact Deutsche Telekom to discuss the applicability if this indicator in Germany.*

BEMP 4.7 – Minimising data traffic demand through green software

1) Description of the BEMP

- Experts suggested to move this BEMP into the chapter on cross-cutting measures. This is expected to be more user-friendly, as readers interested in software will read mostly the cross-cutting measures. This new BEMP will also include the content of the BEMP developed on this topic within the data centre section (BEMP 3.4.2). It will give a global and integrated vision on what can be done regarding software, with impacts for end-user devices, data centres and networks.
 - o *TWG experts (including Patricia, Thomas and Rabih) will provide:*
 - *Examples of the use of "green" software for network management.*
 - *Input on how to restructure the green software BEMPs in the report.*
- The JRC will elaborate a draft of the new BEMP and share it with the TWG.

2) Indicators

- The discussion focused on how to restructure the BEMP for making it relevant within the report, hence indicators will be amended according to the new content of the BEMP.

3) Benchmark of excellence

- The discussion focused on how to restructure the BEMP on make it relevant within the report, hence benchmarks of excellence will be amended according to the new content of the BEMP.

Best environmental practices: greening by ICT

Concerns were raised regarding the ability of telecommunication and ICT companies to measure the savings made by their clients. Experts deemed it easier to measure savings made in-house, but that data from clients could be difficult to obtain. Even legal obstacles can prevent companies from obtaining data, e.g. data protection measures can hinder the right to make use of data on GHG consumption of clients. These concerns apply to the entire "Greening by ICT" chapter.

- *TWG participants were asked to send all relevant information on this topic. JRC suggested experts to send examples of case studies, with EPIs; this would allow readers to pick the EPIs applicable to their business.*

BEMP 5.2 – Digitalisation and dematerialisation

1) Description of the BEMP

- The description of the BEMP proposed in the background report was agreed by the TWG.

2) Indicators

The following changes to indicators were agreed by the TWG:

- (i5): Experts suggested to measure only processes that are completely digitalized (e.g. if you download your ticket online but have to print it afterwards, the impact is limited). Hence (i5) will be reworded as follows to be less specific: "share of products and services delivered digitally to the client".
- Another indicator will be introduced "number of innovative dematerialisation solution proposed to clients"
- Indicators (i2), (i3) and (i4) will be removed, (i1) will be kept.
 - o *Patricia will send the ESGIM report on green ICT maturity model, which is applied by a number of companies and public organisations. One of the areas of the model is greening by ICT and it includes a number of indicators which could be used for identifying other indicators for the BEMPs on greening by.*

Concerns were raised (see also section 'Best environmental practices: greening by ICT') by TWG participants regarding the possibility for companies to implement EPIs on greening by ICT:

- Concerns were raised regarding the ability of companies to measure (i2) number of face to face meetings avoided each year through the use of videoconferencing by clients. In addition, experts suggested that this indicator could go beyond

clients and also cover business partners, e.g. suppliers who don't need to travel to meet the counterparts from the company using videoconferencing.

- Clients use products from telecommunication and ICT companies in very different contexts. This can make the aggregation of benefits provided to customers less relevant (if it is doable, as mentioned in the previous bullet point).
- For all indicators, there would be a need to determine a functional unit/denominator, which remains to be chosen, even if it is very difficult because of the broad range of activities covered by this BEMP.

3) Benchmark of excellence

- No benchmark of excellence was proposed.

BEMP 5.3 – Data collection and communication

1) Description of the BEMP

- Experts suggested to include the concept of "internet of things" into the description of the BEMP and it was also recommended to mention the resulting production of sensors in the cross-media effects.
- Internet of things may allow in the future more easy access to data from customers in order to assess the improvement of environmental performance also to companies providing the greening by ICT solutions.

2) Indicators

- General concerns regarding the ability of companies to measure savings made by clients apply here (see also section 'Best environmental practices: greening by ICT').
- Indicator (i1) will be kept, all the other proposed indicators will be removed
- An indicator could be "number of innovative solutions for data collection and communication proposed to clients".

3) Benchmark of excellence

- No benchmark of excellence was proposed.

BEMP 5.4 – System integration

- TWG participants suggested to merge this BEMP (description, indicators and benchmarks of excellence) with the previous BEMP (5.3 – data collection and communication), as it seems to be too narrow and to overlap with 5.3.

BEMP 5.5 – Process activity and functional optimisation

1) Description of the BEMP

- The description proposed in the background report was agreed by the TWG.

2) Indicators

The following elements were discussed by experts:

- General concerns regarding the ability of companies to measure savings made by clients apply here (see also section 'Best environmental practices: greening by ICT').
- the same approach to identify more suitable indicators as in the previous BEMPs could be adopted

3) Benchmark of excellence

- No benchmark of excellence was proposed.

Annexes

Agenda

Thursday 17th December

Venue: Joint Research Centre, Via Enrico Fermi 2749, I - 21027 Ispra, Italia – Building 36 Room 3

<i>Arrival and registration of participants</i>	09:15 – 10:00
Opening and welcome	10:00 – 10:15
Introduction of experts	10:15 – 10:45
Purpose of the meeting and background: Sectoral Reference Documents and Best Environmental Management Practices	10:45 – 11:15
Introduction to the concepts of Environmental Performance Indicator and Benchmark of Excellence	11:15 – 11:45
Overview of the scope and structure and brief summary of the document	11:45 – 12:30
<i>Lunch break</i>	12:30 – 14:00
Environmental performance indicators and benchmarks of excellence: Crosscutting Measures	14:00 – 15:30
Environmental performance indicators and benchmarks of excellence: best practices for data centres (1)	15:30 – 16:30
<i>Coffee break</i>	16:30 – 16:45
Environmental performance indicators and benchmarks of excellence: best practices for data centres (2)	16:45 – 18:15
<i>Wrap-up and close of the day</i>	18:15 – 18:30

Friday 18th December

Venue: Joint Research Centre, Via Enrico Fermi 2749, I - 21027 Ispra, Italia – Building 36 Room 3

<i>Opening of the day</i>	09:00 – 09:15
Environmental performance indicators and benchmarks of excellence: best practices for telecommunication networks (1)	09:15 – 11:00
<i>Coffee break</i>	11:00 – 11:30
Environmental performance indicators and benchmarks of excellence: best practices for telecommunication networks (2)	11:30 – 12:45
<i>Lunch break</i>	12:45 – 14:15
Environmental performance indicators and benchmarks of excellence: Greening by ICT measures	14:15 – 16:00
<i>Wrap-up and close of the workshop</i>	16:30 – 17:00

List of participants

Participants to the TWG		
Name	Surname	Organisation
Christophe	ABRAHAM	Ernst & Young France
Mark	ACTON	CBRE
Ioannis	ANTONOPOULOS	European Commission - Joint Research Centre
Maria João	AZEREDO	ALERT Life Sciences Computing
Rabih	BASHROUSH	University of East London
Paolo	BERTOLDI	European Commission - Joint Research Centre
Massimo	BERTONCINI	Engineering Ingegneria Informatica
Raffaele	BOLLA	CNIT - University of Genoa
John	BOOTH	Carbon3IT
Paolo	CANFORA	European Commission - Joint Research Centre
Maddy	COBBING	Greenpeace
Thomas	CORVAISIER	GREENSPECTOR
Stéphane	COURION	Centre Informatique pour la Région Bruxelloise
Miguel	COVAS	Portugal Telecom
Bob	CROOKS	UK Dept for Environment Food and Rural Affairs
Flavio	CUCCHIETTI	Telecom Italia
Marco	DRI	European Commission - Joint Research Centre
Eloïse	EMPTOZ	Qarnot Computing
John	GALLAGHER	Roskilde University
Pierre	GAUDILLAT	European Commission - Joint Research Centre
Paolo	GEMMA	ITU-T Huawei
Steve	HONE	Data Centre Alliance
Patricia	LAGO	Vrije Universiteit Amsterdam
Daniel Alberto	MANIEGA SANTANA	Telefonica
Billy	McHALLUM	Equinix
Sébastien	PAQUOT	European Commission - DG Environment
Raphael	REYNAUDI	Ernst & Young France
André	ROUYER	Gimelec
Jack	ROWLEY	GSMA
Theodoros	SAMARAS	Aristotle University of Thessaloniki
Angela	SAXBY	Hewlett Packard Enterprise
Hans-Otto	SCHECK	Nokia
Roger	TIPLEY	Schneider Electric
Alena	TRIFIRO	European Telecommunications Network Operators' Association
Niek	VAN DER PAS	Minkels BV
Johan	VANDERHAEGEN	Proximus

Presentations



Purpose of the meeting and background

Final meeting of the
Technical Working Group on
Best Environmental Management Practice for the
Telecommunication and ICT services Sector



Ispira, 17-18 November 2016

jrc-ipts-emas@ec.europa.eu

European Commission

Joint Research Centre (JRC)

Circular Economy and Industrial Leadership Unit



EMAS



EMAS Performance, Credibility, Transparency

What is EMAS? EU Eco-Management and Audit Scheme



An Environmental Management System



An EU Regulation



An environmental performance reporting tool



EMAS is a commitment to...



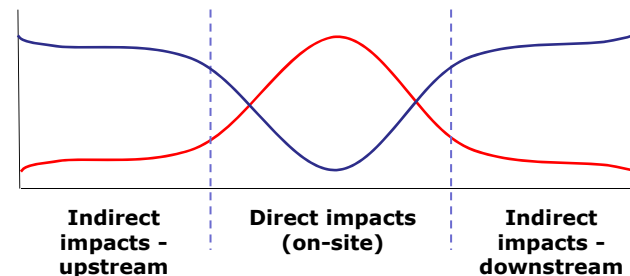
... in environmental performance

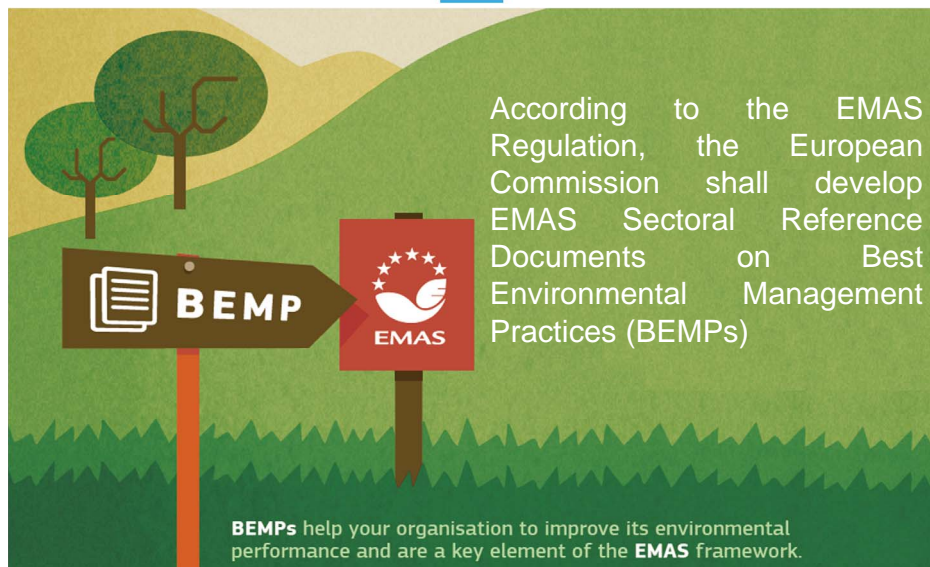


Need to focus on the most relevant
environmental impacts

Size of
environmental
impacts

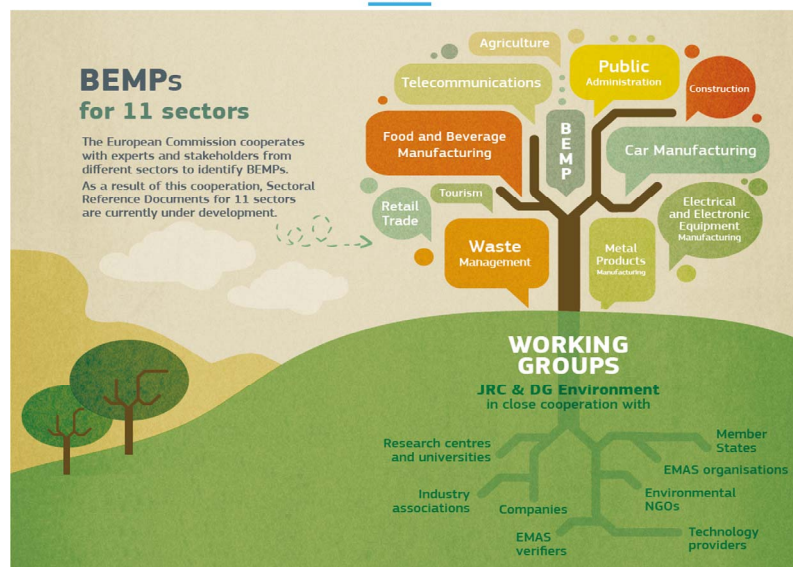
Efforts in a
"classic"
implementation
of
an EMS





The Sectoral Reference Documents on Best Environmental Management Practice

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



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 m² of sales area

- Benchmarks of excellence

Zero food waste sent to landfill or incineration plant

An example from:

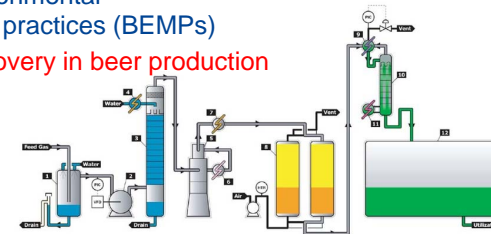


Main elements of the sectoral reference documents

The sectoral reference documents comprise 3 main elements:

- Best environmental management practices (BEMPs)

CO₂ recovery in beer production



- Environmental performance indicators

kg CO₂ recovered / hL beer produced

- Benchmarks of excellence

50% of CO₂ produced by fermentation is recovered

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)

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

BEMP is what goes well beyond common practice

but is already fully implemented

and widely applicable

Best Environmental Management Practices (BEMPs)

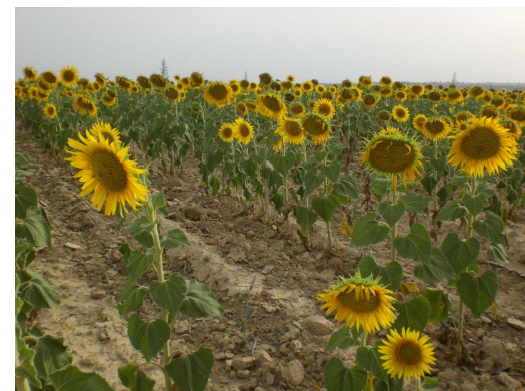
Description of BEMPs (requires detailed technical information):

- 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

How to identify BEMPs

The frontrunner approach



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

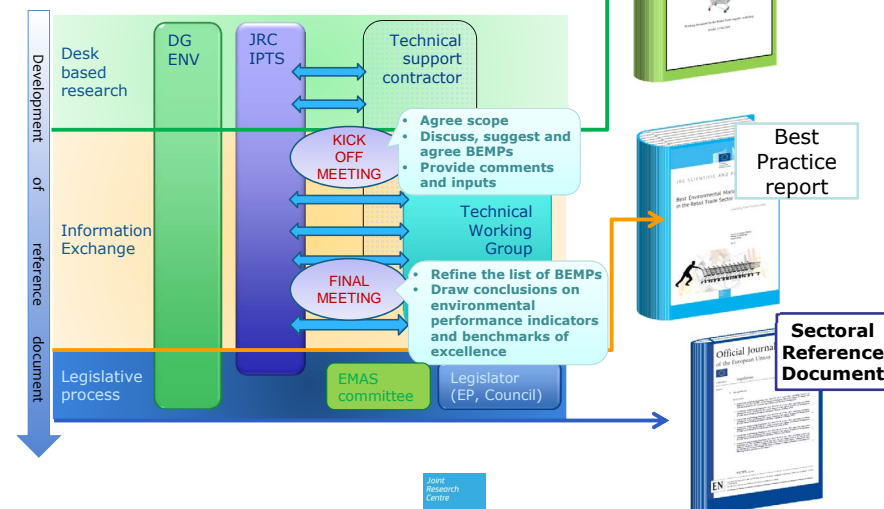
- **Benchmarks of excellence**
 - exemplary environmental performance

very ambitious

achieved by frontrunners

not a target but a measure of what is possible

The EMAS SRD Development Process



The documents produced so far...



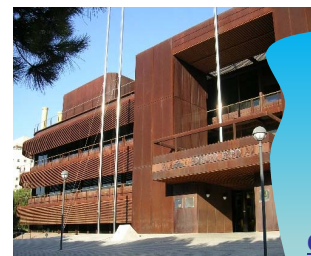
The timeline



Purpose of this final meeting

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

Thank you!



**Paolo Canfora
Marco Dri
Ioannis Sofoklis Antonopoulos
Pierre Gaudillat**

European Commission
Joint Research Centre
Circular Economy and Industrial Leadership Unit

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

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

Environmental performance indicators and benchmarks of excellence

Final meeting of the
Technical Working Group on
Best Environmental Management Practice for the
Telecommunication and ICT services Sector



Ispira, 17-18 November 2016

jrc-ipts-emas@ec.europa.eu

European Commission

Joint Research Centre (JRC)

Circular Economy and Industrial Leadership Unit

Environmental performance and benchmarks of excellence

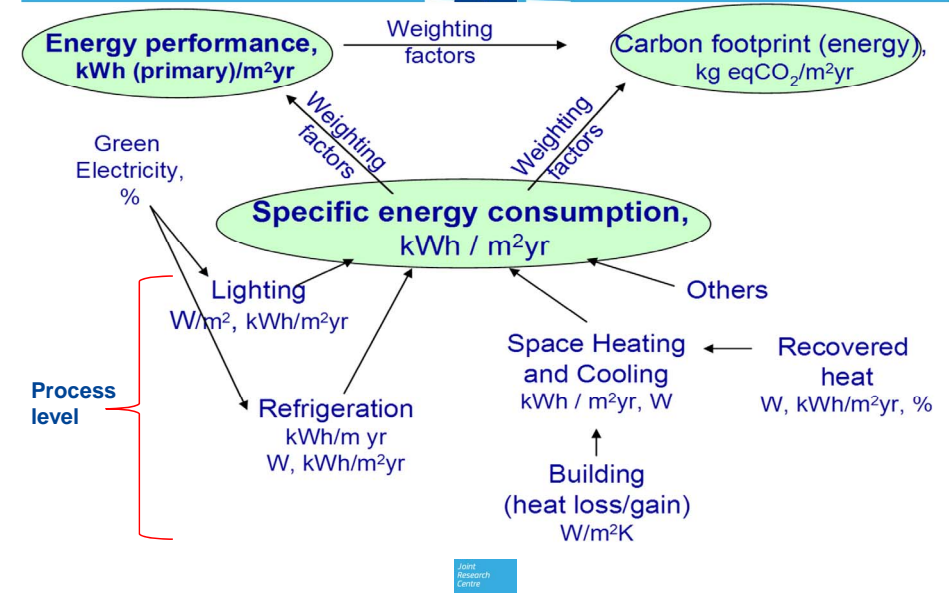
- **Environmental performance indicators:** "specific expression that allows **measurement** of an organisation's **environmental performance**" (EMAS Regulation)

- Core indicators
 - Specific indicators
 - (Alternative indicators)
- (i) Energy efficiency
 - (ii) Material efficiency
 - (iii) Water
 - (iv) Waste
 - (v) Biodiversity and
 - (vi) Emissions.

- **Benchmarks of excellence:** level of **environmental performance** achieved by the **best performers** (frontrunners)

Environmental performance indicators and benchmarks of excellence – sector level

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



Selection of environmental indicators

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

From indicators to benchmarks

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

- ~~The best~~
- Top 10 or **Top 10%**
- ~~Current average in sector~~
- ~~Potential average in sector using "best practice"~~
- etc.
- But then what do we mean by "best practice"?
- Achievable by ~~a few / many / most / all~~ ?
- Taking account of sector-specific economics ?

**Already achieved
by a few**

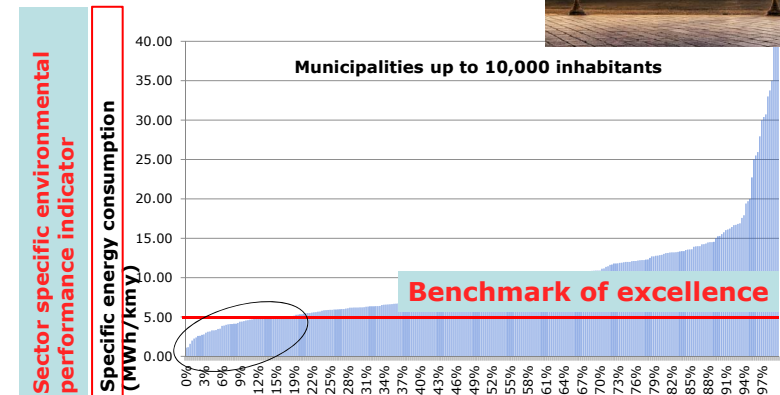
**Applicability and special circumstances
are also taken into account**

Identifying benchmarks of excellence (1)

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

Quantitative benchmark: an example

Public lighting



Own elaboration of data by SAFE - www.topstreetlight.ch

Identifying benchmarks of excellence (2)

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

Use of benchmarks

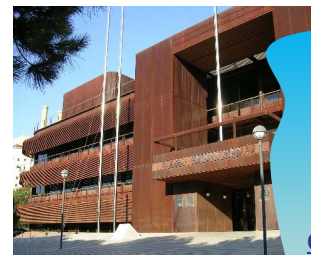
- Provide information to users of **what is potentially achievable** under certain defined circumstances.
- Possibility to **form an opinion** whether an organisation/process is performing well.
- They should be **meaningful** in terms of relevance to **environmental impact**.

Lessons learnt

Environmental performance indicators and benchmarks

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

Thank you!



Paolo Canfora
Marco Dri
Ioannis Sofoklis Antonopoulos
Pierre Gaudillat

European Commission
Joint Research Centre
Circular Economy and Industrial Leadership Unit

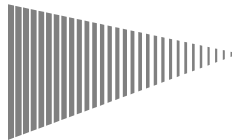
Edificio EXPO
C/ Inca Garcilaso, 3; E-41092 Seville

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

Technical support on Best Environmental Management Practice in the Telecommunications and ICT Services Sector

Final meeting of the Technical Working Group for the EMAS Sectoral
Reference Document

Ispra, 17th and 18th November



1. Overview of the scope of the technical background report



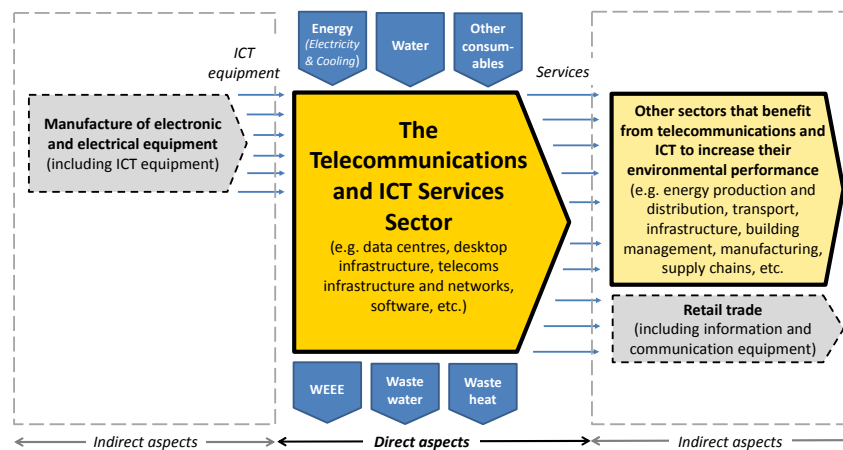
Page 2

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector



1.1 Overview of the scope of activities covered by the technical background report



Page 3

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector



1.2 Target Group

Telecommunications and ICT services providers:

- Telecommunication operators,
- ICT consultancy firms,
- Data processing and hosting companies,
- Software developers and publishers,
- Broadcasters,
- Installers of ICT equipment and sites,
- Etc.

And to some extent: large organisations that store and process large quantities of data of their clients, supply chain and / or products (e.g. public administrations, hospitals, universities, banks, etc.)

BEMPs are divided in 4 chapters:

- 1. Cross-cutting measures:** practices applicable by any telecommunications and ICT services provider
- 2. Data centre:** practices specific to data centre operators or server owners (and their suppliers)
- 3. Telecommunications network:** practices specific to telecommunication operators (and their suppliers)
- 4. Greening by ICT measures:** solutions developed by software developers and telecommunication service providers, and to some extent applicable to the telecommunications and ICT services sector

- Most of the BEMPs are of direct relevance to SMEs (*detailed at the end of each session*)

Page 4

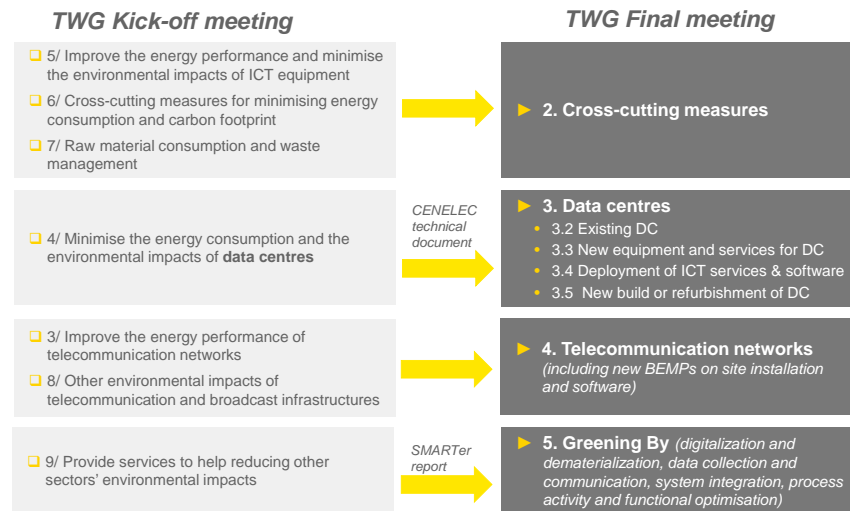
© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector



1.3 A revised structure of the report

See Annex



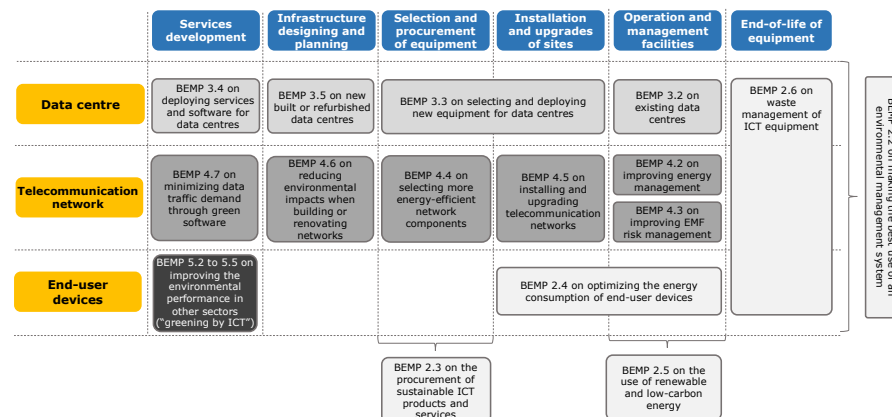
Page 5

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

1.4 Overall presentation of the BEMPs and their applicability



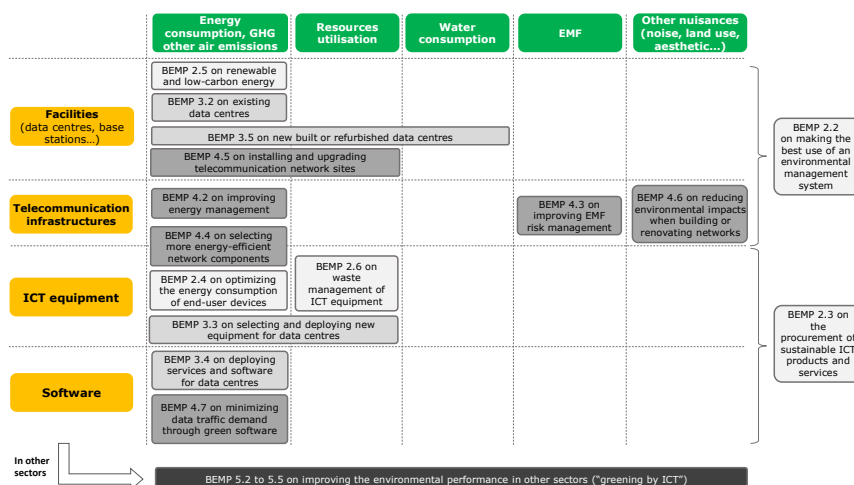
Page 6

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

1.5 Overview of the main environmental aspects and impacts addressed by the BEMPs



Page 7

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

2. Environmental performance indicators and benchmarks of excellence: cross-cutting measures



Page 8

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

2 Cross-cutting measures

► 2.1 Introduction

BEMPs on cross-cutting measures

2.2 Making the best use of an environmental management system

2.3 Procurement of sustainable ICT products and services

2.4 Optimising the energy consumption of end-user devices

2.5 Use of renewable and low-carbon energy

2.6 Waste management of ICT equipment through waste prevention, reuse and recycling

► **Target group:** all types of organisations in the telecommunication and ICT services sector.

► **Objectives:**

- to offer guidance on the design, implementation and monitoring of management frameworks for environmental issues;
- to identify and to optimise environmental impacts across multiple processes, bearing in mind potential trade-offs between different impacts and lifecycle stages.

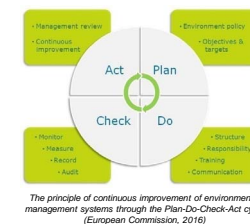
2 Cross-cutting measures

► 2.2 Making the best use an environmental management system (1/3)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Define the organisation's needs and audit the existing ICT equipment, services and software**, in order to assess the needs for replacement and new devices and services.
- **Measure, monitor and manage the environmental performance of ICT equipment, infrastructure and facilities**, through the installation of automated metering equipment (to collect and log environmental performance data), the implementation of real time monitoring, and the involvement of employees and customers to change habits when using ICT equipment.
- **Set objectives and action plans based on benchmarking and best practices** (e.g. Benchmark of Excellence of this technical report).



2 Cross-cutting measures

► 2.2 Making the best use an environmental management system (2/3)

Environmental indicators

- (i1) Implementation of an asset management system certified ISO 55001 (Y/N)
- (i2) Share of facilities or sites with an advanced environmental management system implemented (% of facilities / operations), e.g. EMAS verified, ISO 14001 certified
- (i3) Share of facilities or operations measuring and monitoring energy use and water consumption as well as waste management
- (i4) Share of staff provided at least once with information on environmental objectives and training on relevant environmental management actions
- (i5) Energy use (in kWh) per unit of turnover (€) or network traffic (Terabyte) (for telecommunication network operators)
- (i6) Power Usage Efficiency (PUE) (for data centres)
- (i7) WEEE generation (in kg or tonnes) per unit of turnover (€)
- (i8) Water consumption (m³) per unit of turnover (€) or building surface (m²)
- (i9) Total carbon emissions (in tCO2eq) for scope 1 and 2
- (i10) Total carbon emissions compensated (in tCO2eq) through Clean Development Mechanisms (CDM)
- (i11) Carbon emissions (in tCO2eq) for scope 1 and 2 per unit of turnover (€)

2 Cross-cutting measures

► 2.2 Making the best use an environmental management system (3/3)

Proposed benchmarks of Excellence

- (b1) The company has a global and integrated asset management system certified ISO 55001
- (b2) 100% of facilities are either EMAS verified or ISO 14001 certified
- (b3) 100% of facilities measure and monitor their energy use and water consumption as well as waste management
- (b4) The company is carbon neutral (scope 1 and 2), considering carbon compensation and purchases of green electricity

2 Cross-cutting measures

► 2.3 Procurement of sustainable ICT products and services (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting		Software publishing	End-user devices
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Assess the existing assets of ICT equipment and the needs in the procurement process preparation**, in order to purchase devices and services with appropriate technological capacities and parameters
- **Include in the call for tender required criteria to be met:**
 - Technical requirements (e.g. type of materials used, type of functionalities included, or type of services included, such as maintenance and repair);
 - Grade on environmental performance (energy consumption recyclability, etc.), that can be assessed based on ecolabels, LCA, standards or benchmarks;
 - Total Cost of Ownership (TCO)
- **Ensure proper use by end-users when deploying ICT equipment** through asset management, communication and training.
- **Establish environmental performance criteria for ICT equipment provided to customers** to help them reduce their environmental impact (e.g. scorecards).



2 Cross-cutting measures

► 2.3 Procurement of sustainable ICT products and services (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of products or services purchased by the company complying with specific environmental criteria (e.g. EU Ecolabel, top class energy label, Energy Star, etc.) ► (i2) Share of equipment purchased by the company complying with internationally recognized best practices or requirements (e.g. EU Codes of Conduct) ► (i3) Share of packaging purchased by the company made from recycled materials or awarded the Forest Stewardship Council label ► (i4) Share of the grade given to environmental criteria in calls for tenders ► (i5) Share of suppliers that have an environmental management system or energy management system in place (e.g. EMAS verified, ISO 14001 or ISO 50001 certified) ► (i6) Share of ICT products and services provided by the company to customers for which environmental information is available to customers Environmental criteria include criteria on overall environmental performance, energy efficiency, CO2 emissions, natural resource use and eco-responsible design measures 	<ul style="list-style-type: none"> ► (b1) All ICT equipment purchased by the company is ISO Type I eco-labelled (e.g. EU Ecolabel, Blue Angel) (if available), Energy Star, or EU Green Public Procurement criteria (if available) are applied in its procurement. ► (b2) All broadband equipment purchased by the company meets the criteria in the EU Code of Conduct on broadband equipment ► (b3) 100% of packaging purchased by the company is made from recycled material or was awarded the Forest Stewardship Council label ► (b4) 10% of the bid notation is dedicated to environmental performance when purchasing ICT equipment ► (b5) 100% of products and services provided by the company has related environmental information available to customers

2 Cross-cutting measures

► 2.4 Optimising the energy consumption of end-user devices (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment		Operation and management	Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

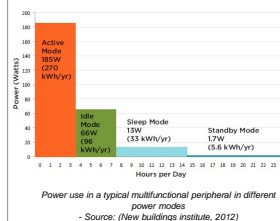
Description

Technical solutions:

- **Installing appropriate devices in terms of energy performance and functionalities depending on the needs of users** (based on the assessment of existing ICT equipment and needs);
- **Properly configuring equipment to minimise unnecessary functionalities and power consumption** (with technicians and power management specialists);
- **Performing regular energy audits to check devices configuration and powered-off devices;**
- **Developing power management solutions** using power management modes (manual, default, through software) or dedicated devices (smart power strip...).

Organisational solutions:

- **Assessing individual user acceptance** to ensure the full implementation of the different technical solutions;
- **Raising users' awareness** to ensure the implementation of the power management policy.



2 Cross-cutting measures

► 2.4 Optimising the energy consumption of end-user devices (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Electricity use of offices (kWh) per unit of turnover or number of employees (excluding HVAC and lightning if possible) ► (i2) Share of end-user ICT devices having been configured by a power management specialist ► (i3) Share of end-user ICT devices audited on power management during the year ► (i4) Share of end-user ICT devices audited on power management at least once during their lifetime ► (i5) Share of staff trained at least once on energy savings 	<ul style="list-style-type: none"> ► (b1) All end-user ICT devices are configured by a power management specialist ► (b2) All end-user ICT devices have been audited on power management during their lifetime ► (b3) All staff has been trained at least once on energy savings

2 Cross-cutting measures

► 2.5 Use of renewable and low-carbon energy (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and EMF	Landscape and biodiversity

Description

- **Purchase third-party green electricity** from the grid (produced from renewable sources).
- **Produce one's own electricity, either on or off-site** (PV panels, wind turbines, biomass cogeneration plant, or if not possible natural gas CHP).
- **Store electricity on-site in an efficient way**, either for replacing backup diesel generators, or for storing electricity produced on site or from the grid (with UPS or fuel cells for example)

Location	Size	Power Installation	Alternative Energy Type	Energy needs covered by renewables
Valencia (Spain)	600 m², 294 racks	4,5 MW	Solar PV on roof	130 kW (3%)
Pamplona (Spain)	100 m², 50 racks	1,5 MW	Biomass boiler	100 kW (2%)
Cork (Ireland)	80 m²	50 kW	Solar PV on roof	22 kW (3%)
Helsinki (Finland)	270 m²	600 kW	Wind turbines on roof	4 kW (8%)
Luxembourg	410 m²	275 kW	Biomass boiler	50 kW (100%)
Brno (Czech Republic)	100 m²	150 kW	Wind turbines on roof	13,5 kW (2%)
			Biomass boiler	100 kW (17%)
			Wind turbines on roof	20 kW (7,5%)
			Biomass boiler	100 kW (36%)
			Biomass boiler	100 kW (67%)

Examples of existing data centres renewable energy use (GENIC, 2014)

2 Cross-cutting measures

► 2.5 Use of renewable and low-carbon energy (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of renewable electricity purchased (with Guarantees of Origin) out of the total electricity use (%) ► (i2) Share of renewable electricity produced on site out of the total electricity use (%) ► (i3) Green Energy Coefficient (GEC) = renewable energy use / total energy use (%) ► (i4) Carbon Usage Effectiveness (CUE) = CO2-eq. emissions from the energy consumption of the facility (kgCO2eq) / total ICT energy consumption (kWh) 	<ul style="list-style-type: none"> ► (b1) 100% of energy used is from renewable energy sources (either purchased or produced on-site)

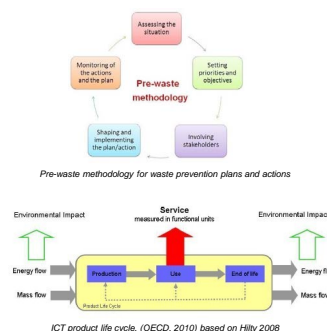
2 Cross-cutting measures

► 2.6 Waste management of ICT equipment through waste prevention, reuse and recycling (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and EMF	Landscape and biodiversity

Description

- **Develop a waste prevention plan.**
- **Promote LCA-based eco-design through procurement**, to help reduce both the initial amount of resources used during manufacturing phase and the final amount of waste generated with more potential for reuse, refurbishment or recycling.
- **Increase the service life and limit the obsolescence of ICT equipment** by carrying out maintenance and checks on the equipment or through facility management services.
- **Implement systems to enable re-use of ICT equipment**, either for company's own equipment (e.g. raising employees awareness, donations to charities, etc.) or client's (e.g. take back programmes).
- **Ensure traceable collection and proper sorting of end-of-life ICT equipment**, through the verification of the waste management contractor's skills and its accreditation.



2 Cross-cutting measures

► 2.6 Waste management of ICT equipment through waste prevention, reuse and recycling (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of facilities or sites with a certified zero waste management system or with a certified asset management system (% of facilities/sites) ► (i2) Average service life of ICT equipment to be calculated for different product groups (e.g. servers, routers, end-user devices) ► (i3) Share of WEEE generated from own operations recovered for reuse or refurbishment or sent for recycling ► (i4) Share of WEEE generated from clients recovered for reuse or refurbishment, or sent for recycling 	<ul style="list-style-type: none"> ► (b1) 100% of facilities have a certified zero waste management system or a certified asset management system ► (b2) 90% of own ICT equipment recovered for reuse or refurbishment or sent for recycling ► (b3) 30% of ICT equipment from clients took back and recovered for reuse or refurbishment or sent for recycling (for ICT companies providing equipment to customers)

2 Cross-cutting measures

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Fully applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. benef.	Comments
2.2 Making the best use of an environmental management system	All companies				Any company can implement an EMS. Resources allocated to the process shall be adapted to the size and the environmental impact of the site or company. A simplified EMAS system is available for SMEs.
2.3 Procurement of sustainable ICT products and services	All companies				Large organizations have greater potential to leverage influence over their suppliers, but SMEs may exert considerable influence over local suppliers. Actions towards products sold to customers are more applicable to the telecommunication sector, with a majority of large firms.
2.4 Optimising energy consumption of end-user devices	All companies				SMEs rely more on organisational solutions than on technical and standardized solutions, even if such solutions are affordable.
2.5 Use of renewable energy	All companies				Costs related to the creation of a renewable energy production unit can be significant. Because this technique requires specific location and space availability, it can be non-applicable for companies which share offices in urban environment (most of the IT services companies).
2.6 Waste management of ICT equipment	All companies				LCA services or training can cost significant amount of money. Actions towards products sold to customers are more applicable to the telecommunication sector, with a majority of large firms.

3. Environmental performance indicators and benchmarks of excellence: data centres



3 Data Centres

► 3.1 Introduction

BEMPs for data centres	
3.2 BEMPs related to existing data centres 3.2.2 Implement an energy management system for data centres 3.2.3 Define and implement a data management and storage policy 3.2.4 Improve airflow management and design 3.2.5 Improve cooling management 3.2.6 Review and adjust temperature and humidity settings	► Categories of data centres: <ul style="list-style-type: none"> Size of the data centre; Geographic location; Purpose or type of operator; Security level. ► Environmental aspects: <ul style="list-style-type: none"> Energy consumption and GHG emissions; Water consumption; Land use and landscape impacts. ► Identification of BEMP: <ul style="list-style-type: none"> European Code of Conduct for Energy Efficiency in Data Centre CENELEC Technical Report CLC/FprTR 50600-99-1 <i>Information technology – Facilities and infrastructures – Data Centre – Energy management – Recommended Practices.</i>
3.3 BEMP related to selecting and deploying new equipment and services for data centres 3.3.2 Selection and deployment of green equipment for data centres	
3.4 BEMP related to the deployment of new ICT services and software 3.4.2 Developing new ICT services and software minimising servers utilisation	
3.5 BEMPs related to new build or refurbishment of data centres 3.5.2 Planning of new data centres 3.5.3 Reuse of data centre waste heat 3.5.4 Design of the data centre building and physical layout 3.5.5 Selecting the geographical location of the new data centre 3.5.6 Use of alternative sources of water	

3.2 Existing Data Centres

► 3.2.1 Scope and structure

Expected (5.1) and optional (6.1) Practices for Existing Data Centres in CLC/FprTR 50600-99-1	BEMPs
Utilisation, management and planning of existing data centres	Implement an energy management system for data centres (including measuring, monitoring and management) (Section 3.2.2) Refer to cross-cutting measures: <ul style="list-style-type: none"> Environmental management systems (Section 3.2.2) Use of renewable and low carbon energy (Section 2.5)
Management of existing ICT equipment and services	Implement an energy management system for data centres (including measuring, monitoring and management) (Section 3.2.2)
Data management and storage	Define and implement a data management and storage policy (Section 3.2.3)
Airflow management and design	Improve airflow management and design (Section 3.2.4)
Cooling management	Improve cooling management (Section 3.2.5)
Temperature and humidity settings	Review and adjust temperature and humidity settings (Section 3.2.6)
Management of existing power equipment	Implement an energy management system for data centres (Section 3.2.2)
Other data centre equipment	Implement an energy management system for data centres (including measuring, monitoring and management) (Section 3.2.2)
Data centre monitoring	Implement an energy management system for data centres (including measuring, monitoring and management) (Section 3.2.2) Refer to cross-cutting measure: <ul style="list-style-type: none"> Environmental management systems (Section 3.2.2)

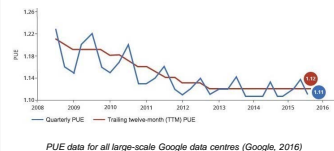
3.2 Existing Data Centres

3.2.2 Implement an energy management system for data centres (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Implement an energy management system** (e.g. ISO 50001 or through EMAS).
- **Audit existing equipment and services** to ensure that all areas with potential for optimisation and consolidation are identified to maximise any unused capability prior to new material investment.
- **Install metering equipment** capable of measuring energy consumption and environmental parameters at different levels (row, cabinet, rack or ICT device level).
- **Monitor and report key performance indicators** on equipment utilisation, energy consumption and environmental conditions.



3.2 Existing Data Centres

3.2.2 Implement an energy management system for data centres (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Energy use of the data centre per floor area (kWh/m²) ► (i2) PUE: Power Usage Effectiveness ► (i3) KPIDCEM Global KPI for Data Centre according to ETSI standard ETSI GS OEU 001 V2.1.1 ► (i4) Share of facilities having an energy management system certified according to ISO 50001 or integrated in EMAS, or complying with the EU Code of Conduct on Data Centre Energy Efficiency or the "expected practices" of CLC/FprTR 50600-99-1. ► (i5) Share of ICT, cooling or power equipment with specific metering equipment (for measuring their use, energy consumption, temperature or humidity conditions) ► (i6) Share of staff provided with information on energy objectives or training on relevant energy management actions during the year 	<ul style="list-style-type: none"> ► (b1) The PUE for existing data centres is equal or lower than 1.5 / The KPIDCEM for existing data centres is equal or lower than 1.5 ► (b2) 100% of facilities have an energy management system certified according to ISO 50001 or integrated in EMAS, or complying with the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the "expected practices" of CLC/FprTR 50600-99-1

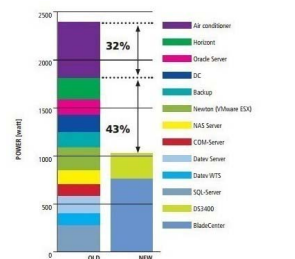
3.2 Existing Data Centres

3.2.3 Define and implement a data management and storage policy (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Implement an effective data management and storage policy** to minimise the share of stored data either unnecessary, duplicated or does not require rapid access (through deduplication, data compression, tiering storage, etc.).
- **Deploy grid and virtualisation technologies** to maximise the use of shared platforms.
- **Consolidate existing services and decommission unnecessary hardware** to reduce the number of highly resilient and reliable hardware powered (servers, networking and storage equipment).



3.2 Existing Data Centres

3.2.3 Define and implement a data management and storage policy (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Energy use (kWh) per rack ► (i2) Server PUE (SPUE) = (Server Input Power) / (Computation Useful Power) ► (i3) Average storage disks space utilisation (%) ► (i4) Average server utilisation (%) ► (i5) Share of servers virtualised (%) ► (i6) Share of facilities or sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding data management and storage, and management of existing ICT equipment and services 	<ul style="list-style-type: none"> ► (b1) The average server utilisation in data centres is higher than 40% ► (b2) The Server PUE for existing servers is equal or lower than 1.2 ► (b3) 80% of servers or more are virtualised ► (b4) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding data management and storage, and management of existing ICT equipment and services.

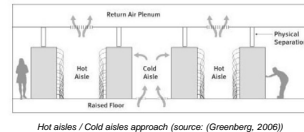
3.2 Existing Data Centres

▶ 3.2.4 Improve airflow management and design (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- ▶ **Implement a hot aisle / cold aisle configuration** for ICT equipment to ensure that hardware shares an air flow direction without mixing cold and hot air.
- ▶ **Ensure aisles separation and containment** to avoid the recirculation of air around the servers.
- ▶ **Segregate ICT equipment according to their environmental requirement** (mainly humidity and temperature) and provide appropriate airflows to separate environmental areas.
- ▶ **Improve the floor and ceiling design** to reduce bypass air flow, to prevent re-circulated air, and to reduce obstructions created by cabling or other structures.
- ▶ **Adjust volumes and quality of supplied cooled air** to the IT equipment needs (function of heat produced and environmental requirements), and provide a slight oversupply of air to minimise heated air recirculation.



3.2 Existing Data Centres

▶ 3.2.4 Improve airflow management and design (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none">▶ (i1) Air flow efficiency (fan power in kWh / fan airflow in m3/hour)▶ (i2) Return Temperature Index (identification of air recirculation)▶ (i3) Flow performance of the air handler▶ (i4) Thermal performance of the air handler▶ (i5) Rack cooling index (difference between allowable intake temperature and the one recommended by ASHRAE)▶ (i6) Share of racks installed with hot aisle/cold aisle configuration (with containment)▶ (i7) Share of facilities or sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding airflow management and design, and installation of ICT equipment to optimise airflow management	<ul style="list-style-type: none">▶ (b1) All existing racks (at facility or company level) have an average Rack Cooling Index equal to 96% or above▶ (b2) 100% of new racks are installed with hot aisle/cold aisle configuration (with containment)▶ (b3) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding airflow management and design, and installation of ICT equipment to optimise airflow management.

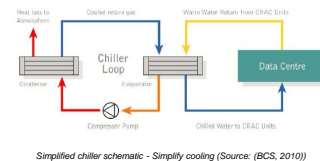
3.2 Existing Data Centres

▶ 3.2.5 Improve cooling management (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- ▶ **Maintain the cooling system close to its original condition** to preserve its efficiency (with a regular maintenance of equipment).
- ▶ **Review and adapt the cooling system capacity** by shutting down unused equipment and better taking into account specific equipment operating requirements.
- ▶ **Optimise and automate the cooling system output** by connecting CRAC units or using smart and multifactor units.



3.2 Existing Data Centres

▶ 3.2.5 Improve cooling management (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none">▶ (i1) COP (coefficient of performance): average cooling load (kW) / average cooling system power (kW)▶ (i2) Share of data centre total energy use dedicated to the cooling system (%)▶ (i3) Power Usage Effectiveness (PUE)▶ (i4) Carbon Usage Effectiveness (CUE)▶ (i5) Water Usage Effectiveness (WUE)▶ (i6) Share of facilities or sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency (parts 5.2, 5.4 and 5.5) or the Expected Practices of CLC/FprTR 50600-99-1 regarding cooling management	<ul style="list-style-type: none">▶ (b1) The COP is 7 or higher for water chillers, and 4 or higher for Direct Expansion (DX) cooling systems▶ (b2) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency (parts 5.2, 5.4 and 5.5) or the expected practices of CLC/FprTR 50600-99-1 regarding cooling management

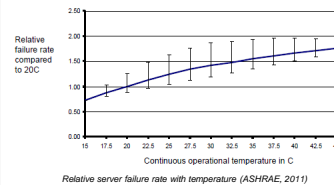
3.2 Existing Data Centres

► 3.2.6 Review and adjust temperature and humidity settings (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Review and raise temperature set points of cooling systems** if practical, to reduce cooling needs and maximise the use of economisers.
- **Review and change humidity settings of cooling systems** if practical, to reduce the needs for humidifiers.



3.2 Existing Data Centres

► 3.2.6 Review and adjust temperature and humidity settings (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Airflow Efficiency (fan power in kWh / fan airflow in m³/hour) ► (i2) Return Temperature Index (RTI) ► (i3) Share of facilities or sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding temperature and humidity settings 	<ul style="list-style-type: none"> ► (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding temperature and humidity settings

3.2 Existing Data Centres

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. Benef.	Comments
3.2.2 Implement an energy management system for data centres	Data centre operators				Some technology intensive automated data management tools can be very costly, especially for smaller size structures. The tools are mainly for large size data centres because of heavy upfront investments.
3.2.3 Define and implement a data management and storage policy	Servers owners				These practices can be implemented by most data centres and server rooms.
3.2.4 Improve airflow management and design	Data centre operators				If the best practices identified before can be implemented in data centres of any size, scale effects can be observed in larger data centres with shorter return of investments.
3.2.5 Improve cooling management	Data centre operators				Maintaining the cooling system and carrying out regular reviews of its capacities can be done in most data centres. However, automating the cooling system output can imply costs to purchase smart equipment, making it more appropriate for large size data centres.
3.2.6 Review and adjust temperature and humidity settings	Data centre operators				Raising temperature set points, adjusting volumes and quality of supplied cool air, and reviewing humidity settings can be done in most data centres, irrespectively of their size, security level or purpose.

3.3 Selection and deployment of green equipment for data centres

► 3.3.1 Scope and structure

Expected (5.2) and optional (6.2) Practices for ICT equipment (new or replacement) in CLC/FprTR 50600-99-1	BEMPs
Selection and deployment of new ICT equipment	Selection and deployment of equipment for data centres (Section 3.3.2) Refer to cross-cutting measure: <ul style="list-style-type: none"> • Procurement of sustainable ICT products and services (Section 2.3)
Management of existing ICT equipment and services	Refer to another data centre BEMP: <ul style="list-style-type: none"> • Define and implement a data management and storage policy (Section 3.2.3)
Selection and deployment of new ICT services	Refer to another data centre BEMP: <ul style="list-style-type: none"> • Define and implement a data management and storage policy (Section 3.2.3)
Installation of ICT equipment to optimise airflow management	Refer to another data centre BEMP: <ul style="list-style-type: none"> • Improve airflow management and design (Section 3.2.4)

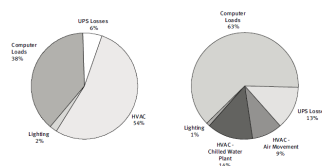
3.3 Selection and deployment of green equipment for data centres

3.3.2 Selection and deployment of green equipment for data centres (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Implement a green procurement policy specific to data centres equipment**, from process preparation to bid evaluation.
- **Select and install environmental-performant servers and storage equipment**; i.e. equipment with enable power management features, equipment suitable for the data centre power density and cooling delivery capabilities, equipment meeting the expected environmental conditions (temperature and humidity), etc.
- **Select environmental-performant cooling equipment**; i.e. equipment with high CoP or variable speed controls, appropriately sized cooling units, centralised cooling systems, economisers, etc..
- **Select environmental-performant power equipment**; i.e. highly efficient UPS, modular UPS, etc.



Distribution of electricity consumption of two data centres, one using multiple CRAC units (on the left), and one functioning with a centralised air handling (on the right) (source: (PG&E, 2012))

3.3 Selection and deployment of green equipment for data centres

3.3.2 Selection and deployment of green equipment for data centres (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of ICT products or services purchased by the company complying with specific environmental criteria (e.g. EU Ecolabel, Energy Star, Blue Angel, etc.) ► (i2) Share of suppliers that have an environmental management system or energy management system in place (e.g. EMAS verified, ISO 14001 or ISO 50001 certified) ► (i3) Share of facilities that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding the selection and deployment of new ICT equipment / of cooling system / of new power equipment / of other data centre equipment. ► (i4) Average energy efficiency of UPS (given by manufacturers) ► (i5) Average COP of cooling equipment (given by manufacturers) 	<ul style="list-style-type: none"> ► (b1) All new Data Centre ICT equipment is ISO Type I eco-labelled (e.g. EU Ecolabel, Blue Angel, etc.) (if available) or Energy Star labelled ► (b2) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding the selection and deployment of new ICT equipment / of cooling system / of new power equipment / of other data centre equipment. ► (b3) Average UPS efficiency over 97% ► (b4) The COP is 7 or higher for water chillers, and 4 or higher for Direct Expansion (DX) cooling systems

3.3 Selection and deployment of green equipment for data centres

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. Benef.	Comments
3.3.2 Selection and deployment of green equipment for data centres	Data centre operators				Depending on the type of equipment that is selected, costs can be significantly higher, and more difficult to afford for SMEs.

3.4 Deployment of new ICT services and software

► 3.4.1 Scope and structure

Expected (5.3) and optional (6.3) Practices for software install or upgrade in CLC/FprTR 50600-99-1	BEMPs
Deployment of new IT services	Developing new ICT services and software minimising servers utilisation (Section 3.4.2) Refer to cross-cutting measure: • Procurement of sustainable ICT products and services (Section 2.3)

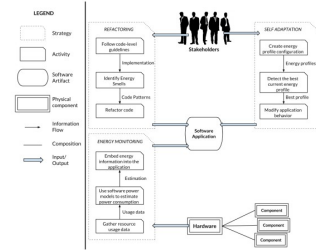
3.4 Deployment of new ICT services and software

► 3.4.2 Developing new ICT services and software minimising servers utilisation (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Select energy efficient software** that minimises power consumption of ICT equipment while running.
- **Develop internally or outsourced energy-efficient software** that uses the least energy to perform the required task (reduction of data movement, computational efficiency, etc.).
- **Monitor the energy consumption of software** (as well as CPU and RAM) to assess the real performance of the acquired software, or to assess the opportunity of improving the energy efficiency of existing software.
- **Refactor existing software** to improve its energy efficiency (cleaning up useless code and data, looking for immortals, checking loops, reducing the amount of data transferred, etc.).



Framework for energy efficient software strategies (Procaccianti, 2015)

3.4 Deployment of new ICT services and software

► 3.4.2 Developing new ICT services and software minimising servers utilisation (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of new acquired software for which energy performance has been used as a selection criteria (%) ► (i2) Share of new developed software for which the energy consumption has been used as a development criteria (%) ► (i3) Share of existing software which has been refactored (%) ► (i4) Share of software for which the energy use has been assessed (%) ► (i5) Share of sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding the development and deployment of new IT services. 	<ul style="list-style-type: none"> ► (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding the development and deployment of new IT services.

3.4 Deployment of new ICT services and software

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. benef.	Comments
3.4.2 Developing new ICT services and software minimising servers utilisation	Software developers and servers owners				These solutions require to mobilize internal means (skills and R&D investments) or to purchase consulting work, more applicable to larger organisations.

3.5 New build or refurbishment of data centres

► 3.5.1 Scope and structure

Expected (5.4) and optional (6.4) Practices for new build or refurbishment of Data Centres in CLC/FprTR 50600-99-1	BEMPs
Utilisation, management and planning of existing data centres	Planning of new data centres (Section 3.5.2) Refer to other BEMPs: <ul style="list-style-type: none"> • Environmental management systems (Section 2.2) • Use of renewable and low carbon energy (Section 2.5) • Selection and deployment of equipment for data centres (Section 3.3.2)
Airflow management and design	Refer to another data centre BEMP: <ul style="list-style-type: none"> • Improve airflow management and design (Section 3.2.4)
Selection of cooling system	Refer to other BEMPs: <ul style="list-style-type: none"> • Procurement of sustainable ICT products and services (Section 2.3) • Selection and deployment of equipment for data centres (Section 3.3.2)
Selection and deployment of new power equipment	Refer to other BEMPs: <ul style="list-style-type: none"> • Procurement of sustainable ICT products and services (Section 2.3) • Selection and deployment of equipment for data centres (Section 3.3.2)
Other data centre equipment	Refer to another data centre BEMP: <ul style="list-style-type: none"> • Selection and deployment of equipment for data centres (Section 3.3.2)
Reuse of data centre waste heat	Reuse of data centre waste heat (Section 3.5.3)
Data centre building physical layout	Design of the data centre building and physical layout (Section 3.5.4)
Data centre geographical location	Selecting the geographical location of new data centre (Section 3.5.5)
Water sources	Use alternative water sources (Section 3.5.6)
Data centre monitoring	Refer to another data centre BEMP: <ul style="list-style-type: none"> • Implement an energy management system for data centres (Section 3.2.2)

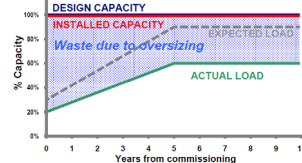
3.5 New build or refurbishment of data centres

3.5.2 Planning of new data centres (1/2)

ICT components				
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices
Relevant lifecycle stages				
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management
Main environmental benefits				
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations
				Landscape and biodiversity

Description

- Limit the level of physical infrastructure resilience and service availability according to business requirements (e.g. multi-path infrastructures can be unnecessary and inappropriate).
- Build a modular data centre to avoid oversizing and maximise infrastructure efficiency under partial and variable load conditions (e.g. single power supplies or optional grey power feeds without UPS).



Evolution of the IT load of a typical data centre (Source: (Rasmussen, 2011))

3.5 New build or refurbishment of data centres

3.5.2 Planning of new data centres (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> (i1) Energy use of the data centre per floor area (kWh/m²) (i2) Power Usage Effectiveness (PUE) (i3) Share of sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding Utilisation, management and planning of new build or refurbishment of data centres 	<ul style="list-style-type: none"> (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding utilisation, management and planning of new build and refurbishment of data centres

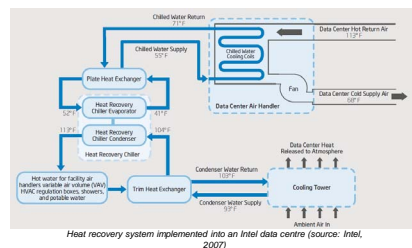
3.5 New build or refurbishment of data centres

3.5.3 Reuse of data centres waste heat (1/2)

ICT components				
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices
Relevant lifecycle stages				
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management
Main environmental benefits				
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations
				Landscape and biodiversity

Description

- Re-use the waste heat produced in some rooms of the data centre to provide low grade heating to industrial or office space (including other areas of the data centre).



Heat recovery system implemented into an Intel data centre (source: Intel, 2007)

3.5 New build or refurbishment of data centres

3.5.3 Reuse of data centres waste heat (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> (i1) Energy Reuse Factor (ERF) = (Total energy – Reused Energy) / IT energy (i2) Energy Reuse Effectiveness (ERE) = Reused energy / Total energy (i3) Share of sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding reuse of data centre waste heat 	<ul style="list-style-type: none"> (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding reuse of data centre waste heat

3.5 New build or refurbishment of data centres

► 3.5.4 Design of the data centre building and physical layout (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Minimise direct solar heating of the cooled areas** of the data centre, in order to minimise cooling requirements.
- **Locate cooling equipment in appropriate areas of the data centre**, such as areas with free air movement, areas with sufficient space to optimize cooling performance, areas free of obstructions and free of equipment generating heat.

3.5 New build or refurbishment of data centres

► 3.5.4 Design of the data centre building and physical layout (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding data centre building physical layout 	<ul style="list-style-type: none"> ► (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding data centre building physical layout

3.5 New build or refurbishment of data centres

► 3.5.5 Selecting the geographical location of the new data centre (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Select a geographical location with environmental conditions** improving the performance of side-economisers, offering opportunities for installing equipment for the production of renewable energy or limiting threats and natural disasters (such as flooding).
- **Locate the data centre close to energy, cooling and heating sources**, to minimise energy losses due to energy transport and to offer opportunities for the reduction of carbon emissions (consumption of renewable energy, waste heat or free cooling).
- **Minimise impacts of the building on the environment** (noise, aesthetic impacts, needs for telecommunication networks and other infrastructures, etc.).



Average free Cooling or Economizer average external air usage level Classification:

LEVEL	HOURS/YEAR
1	>7500
2	>6500 & <7500
3	<6500

Average yearly number of free-cooling usage hours (GENIC, 2014)

3.5 New build or refurbishment of data centres

► 3.5.5 Selecting the geographical location of the new data centre (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of new facilities with free cooling solutions (air-side economisers, geothermal cooling, etc.) ► (i2) Share of new facilities with renewable energy production on site (photovoltaic panels, wind turbine, etc.) ► (i3) Share of new facilities with heat reuse systems ► (i4) Share of sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding data centre geographical location 	<ul style="list-style-type: none"> ► (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected and optional practices of CLC/FprTR 50600-99-1 regarding data centre geographical location

3.5 New build or refurbishment of data centres

► 3.5.6 Use of alternative sources of water (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Monitor water consumption** from all sources in all data centre spaces.
- **Limit impact on potable water resources by using non-potable water sources** (rainwater, wastewater, etc.).

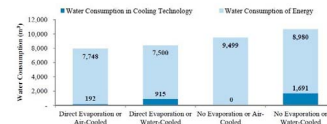


Figure 6. Annual water consumption of different cooling technologies in a DC cooling technology with a capacity of 61,164 m³/min, based on inlet supply temperature to servers of 27 °C in Phoenix, Arizona. (After Yokom [74] who reports United Metals Products values. Yokom uses National Renewable Energy Laboratory (NREL) figures for the water consumption for electricity production (8254 m³/TJ) [75]. Note that NREL is using only evaporative water consumption not WF).

Annual water consumption of different cooling technologies in data centres - Source: (B. Ristic, K. Medari and Z. Matusch, 2015)

3.5 New build or refurbishment of data centres

► 3.5.6 Use of alternative sources of water (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Share of water consumed in data centres by source, such as mains water, rainwater or non-utility water sources ► (i2) Water consumption of the data centre per floor area (m³ consumed /m² of data centre) ► (i3) Water Usage Effectiveness (WUE) ► (i4) Share of sites that have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the Expected Practices of CLC/FprTR 50600-99-1 regarding water sources 	<ul style="list-style-type: none"> ► (b1) All facilities or sites have implemented the best practices in the EU Code of Conduct on Data Centre Energy Efficiency or the expected practices of CLC/FprTR 50600-99-1 regarding water sources

3.5 New build or refurbishment of data centres

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. Benef.	Comments
3.5.2 Planning of new data centres	Data centre operators				Building a data centre according to a modular architecture is particularly relevant for big data centres.
3.5.3 Reuse of data centre waste heat	Data centre operators				Opportunities for reusing waste heat from a data centre is more applicable to larger data centres, except with a decentralized system (servers place in the rooms that they directly heat).
3.5.4 Design of the data centre building and physical layout	Data centre operators				These techniques are most relevant for building new, enterprise-class data centres, as these practices aim to shape the aspect and structure of the new built data centre and can be costly to implement.
3.5.5 Selecting the geographical location of the new data centre	Data centre operators				Locating a data centre according to its energy-efficiency potential is particularly relevant for large data centres.
3.5.6 Use of alternative sources of water	Data centre operators				These practices are relevant for large, enterprise-class data centres.

4. Environmental performance indicators and benchmarks of excellence: telecommunication networks



4 Telecommunication networks

► 4.1 Introduction

BEMPs for telecommunication networks

4.2 Improving the management of existing telecommunication networks

4.3 Improving risk management for electromagnetic fields through assessment and transparency of data

4.4 Selecting and deploying more energy-efficient telecommunication network equipment

4.5 Installing and upgrading telecommunication networks

4.6 Reducing the environmental impacts when building or renovating telecommunication networks

4.7 Minimising data traffic demand through green software

► Categorisation:

- Network segment;
- Technology;
- End-user type.

► Environmental aspects:

- Energy consumption and GHG emissions;
- EMF;
- Land use and landscape impacts.

Page 57

© 2016 Property of Ernst & Young of Associates
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

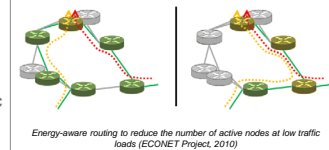
4 Telecommunication networks

► 4.2 Improving the management of existing telecommunication networks (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and EMF	Landscape and biodiversity

Description

- **Measure the energy consumption of network elements** by using smart energy meters and automated analysis.
- **Use smart stand-by functions** to implement network energy management, and switch as many devices as possible to low consumption mode when the traffic load is low to adapt the overall capacity of the network to the demand.
- **Use dynamic power scaling opportunities** to adapt the operation mode of network equipment to low or moderate traffic period times.
- **Take advantage of dynamic scheduling transmission** to better manage data traffic, and to control the amount and the timing of data packet transmission.
- **Provide energy-aware services** to reduce the traffic demand at peak load, as well as the overall capacity of the network.



Page 58

© 2016 Property of Ernst & Young of Associates
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

4 Telecommunication networks

► 4.2 Improving the management of existing telecommunication networks (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Power consumption per customer or subscriber in kWh / customer or subscriber ► (i2) Mobile Network coverage Energy Efficiency (the area covered by the mobile network / the energy consumption) in m² / J ► (i3) Mobile Network data Energy Efficiency (the data volume delivered / the energy consumption) in bit / J ► (i4) Network minimum power consumption divided by network maximum power consumption (in %) ► (i5) Share of network nodes for which energy consumption is measured (in %) ► (i6) Share of network nodes for which dynamic power management solutions (such as dynamic power scaling or dynamic scheduling transmission) are implemented (in %) 	<ul style="list-style-type: none"> ► (b1) 50% of the network energy usage is real-time monitored through sub-meters at telecommunication sites level (base stations and / or fixed-network nodes), or above

Page 59

© 2016 Property of Ernst & Young of Associates
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

4 Telecommunication networks

► 4.3 Improving risk management for electromagnetic fields through assessment and transparency of data (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment		Operation and management	Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Improve risk management for electromagnetic fields** through assessment and transparency of data on EMF exposure (sample measurements, continuous measuring, calculation, staff information, communication plan, etc.), to demonstrate a good level of risk management.



Typical radio and wireless communications in the community (source: ITU, 2014)

Page 60

© 2016 Property of Ernst & Young of Associates
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

► 4.3 Improving risk management for electromagnetic fields through assessment and transparency of data (2/2)

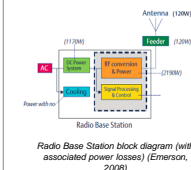
Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ▶ (i1) Percentage of sites assessed for compliance with EMF limits ▶ (i2) Percentage of the public expressing concerns about EMF from telecommunication networks 	▶ NA

► 4.4 Selecting and deploying more energy-efficient telecommunication network equipment (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management		Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- ▶ **Prioritise selection and deployment of the most energy-efficient ICT equipment** (radio, telecommunication, broadband and IT devices) in telecommunication networks (more energy efficient technology, power management features, etc.).
- ▶ **Prioritise deployment of integrated and multi-standard solutions**, instead of multiple single-standard systems running in parallel and not properly configured.
- ▶ **Prioritise selection and deployment of the most energy-efficient cooling systems** in base stations (e.g. passive cooling, simple fans, heat exchangers, etc.) and central offices (e.g. hot aisle / cold aisle blanking plates, hot air containments, air ducting, etc.).
- ▶ **Prioritise selection and deployment of the most energy-efficient UPS** (e.g. high efficient UPS, modular UPS, etc.) in base stations and central offices.
- ▶ **Prioritise design of telecommunication sites maximising energy-efficiency** by migrating distributed functions to central servers in wireline networks, moving radio equipment closer to the antenna, and using an appropriate design of UPS.
- ▶ **Use software enabling energy savings all along the network**, to implement virtualisation (for increasing equipment sharing and reducing the number of needed hardware equipment) or networking functions (for allowing a greater flexibility and efficiency of the network).



► 4.4 Selecting and deploying more energy-efficient telecommunication network equipment (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ▶ (i1) Percentage of broadband equipment meeting the Broadband Code of Conduct requirements in terms of energy consumptions ▶ (i2) Share of base stations with multi-standard solutions ▶ (i3) Average UPS System Efficiency ▶ (i4) Average COP of cooling systems ▶ (i5) Share of base stations with a Remote Radio Head or Active Antenna System 	<ul style="list-style-type: none"> ▶ (b1) 100% of new installed broadband equipment meets the requirements of the EU Code of Conduct for broadband equipment in terms of energy consumptions ▶ (b2) The UPS System Efficiency is 97% or higher ▶ (b3) The COP is 4 or higher for Direct Expansion (DX) cooling systems (including free cooling or thermosyphon)

► 4.5 Installing and upgrading telecommunication networks (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- ▶ **Take advantage of technology transition** (e.g. deploying 4G technology in existing base station sites) **to optimise network sites** (decommission of unused equipment, replacing of obsolete equipment, proper configuration of cooling systems, etc.) through the integration of such practices in a management process focused on upgrading telecommunication sites (including base station sites).

4 Telecommunication networks

► 4.5 Installing and upgrading telecommunication networks (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Mobile Network data Energy Efficiency (EEMN,DV) ► (i2) Mobile Network coverage Energy Efficiency (EEMN,CoA) ► (i3) Average lifetime of ICT equipment in network sites ► (i4) Share of ICT equipment decommissioned and removed from base station sites each year 	<ul style="list-style-type: none"> ► (b1) A plan and a management process for optimising all existing network sites have been defined (to remove unused and obsolete equipment, to properly configure cooling systems, etc.)

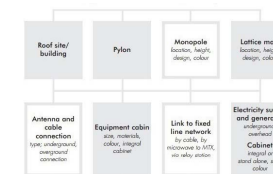
4 Telecommunication networks

► 4.6 Reducing the environmental impacts when building or renovating telecommunication networks (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting	Software publishing	End-user devices	
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment	Operation and management	Renovation and upgrades	End-of-life management	
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Co-locate ICT infrastructures**, in order to limit the number of different infrastructures.
- **Locate network infrastructures** (fixe-lined, antennas, buildings, etc.) **close to existing access roads and out of conservation areas.**
- **Install noise reducing solutions**, such as barriers, absorptive material or mufflers.



4 Telecommunication networks

► 4.6 Reducing the environmental impacts when building or renovating telecommunication networks (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Percentage of sites shared with other operators ► (i2) Spread between the maximum legally authorised sound value in an area and the sound emitted by the equipment of a base station site (power generator and air conditioning system, in dB) ► (i3) Noise Reduction Coefficient (from 0 to 1) of the material used to lower the transmission of sound from the base station to the surroundings 	<ul style="list-style-type: none"> ► (b1) At least 30% of sites are shared with other operators

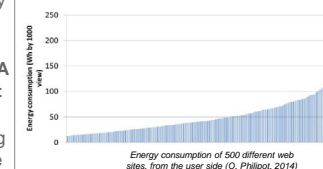
4 Telecommunication networks

► 4.7 Minimising data traffic demand through green software (1/2)

ICT components					
Data centre	Telecommunication network	Broadcasting		Software publishing	End-user devices
Relevant lifecycle stages					
Design and installation	Selection and procurement of the equipment		Operation and management	Renovation and upgrades	End-of-life management
Main environmental benefits					
Energy consumption	Resources consumption	Air emissions	Water use & consumption	Noise and electromagnetic radiations	Landscape and biodiversity

Description

- **Design demand-adaptive software** based on the assessment of end-users needs, in order to avoid energy over-consumption at usage phase and to limit the obsolescence of existing ICT devices.
- **Assess software environmental impacts through LCA** at development phase and **performance measurement** (CPU, RAM and energy utilisation) at usage phase.
- **Develop more energy efficient software**; e.g. providing different image resolutions, preferably connecting mobile devices via LAN or WLAN (rather than mobile network), or implement mobile apps' solutions when developing software for stationary equipment.



4 Telecommunication networks

► 4.7 Minimising data traffic demand through green software (2/2)

Environmental indicators	Proposed benchmark of Excellence
<ul style="list-style-type: none"> ► (i1) Amount of data transferred in relation with software utilisation (bit / web page view or bit / min of mobile application use) ► (i2) Share of demand-adaptive designed software among the portfolio dedicated to internal or external use (published software) ► (i3) Share of software for which a LCA has been carried out among the portfolio dedicated to internal or external use (published software) ► (i4) Share of software for which the energy performance has been measured among the portfolio dedicated to internal or external use (published software) ► (i5) Share of existing software which has been refactored toward higher efficiency among the portfolio dedicated to internal or external use (published software) 	<ul style="list-style-type: none"> ► (b1) At least one project for minimising data traffic demand through green software was implemented during the year

4 Telecommunication networks

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. Benef.	Comments
4.2 Improving the management of existing telecommunication networks	Network operators				As network operators are mostly large companies, these BEMPs are mainly applicable to large companies. However, SMEs providing ICT services have the opportunity to facilitate the provision of energy-aware services, by defining appropriate Quality of Services requirements and by choosing relevant network technologies.
4.3 Improved risk management for electromagnetic fields thanks to monitoring and transparency of data	Network operators				As network operators are mostly large companies, these BEMPs are typically only applicable to large companies.
4.4 Selecting and deploying more energy-efficient telecommunication network equipment	Network operators				Only few telecommunication operators or Internet providers own wireline or wireless networks and can engineer changes within these networks. Most of these companies are large sized companies.

4 Telecommunication networks

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. Benef.	Comments
4.5 Installing and upgrading telecommunication networks	Network operators				Telecommunication operators and their suppliers in charge of the installation of ICT equipment are the main actors concerned by this technique. This technique is more relevant for large mobile companies which own thousands of sites, and for operators of networks in rural areas (where the sites are more spaced out).
4.6 Reducing the environmental impacts when building or renovating telecommunication networks	Network operators				Only few telecommunication operators or Internet providers own wireline or wireless networks and can engineer changes within these networks. Most of these companies are large sized companies. Local authority planning policies can limit the capacity of operators to develop their network in specific areas.
4.7 Design of web portals and mobile applications to limit data traffic demand	Software developers and users				Using eco-design solutions when developing or optimizing applications refer to a set of techniques that can be applied by software publishers (for an external use of software) or by any type of company using applications for its own usage. IT consulting firms (including SMEs) can help these companies develop such innovative solutions.

5. Environmental performance indicators and benchmarks of excellence: greening by ICT



5 Greening by ICT

► 5.1 Introduction (1/3)

Greening By ICT BEMPS

5.2 Digitalization and dematerialization

5.3 Data collection and communication

5.4 System integration

5.5 Process activity and functional optimisation

► From an ICT company perspective, it is best practice to:

- Keep on developing new solutions that offer opportunities to reduce environmental impacts (through R&D investments, partnerships with companies from other sectors, etc.);
- Help companies deploying such solutions into their operations and business (by specifically design the solution to its client needs, by providing training and communication, etc.);
- Internally deploy these solutions, if relevant.

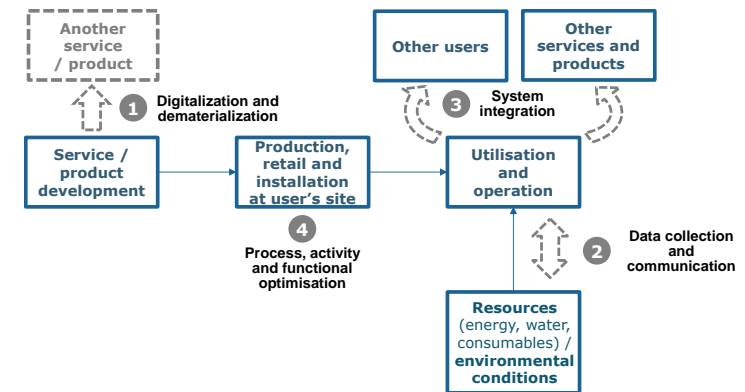
► **Scope:** These BEMPs do not explain how to create or sell such solutions (business development), but develop the main principles behind and describe solutions already implemented in companies from other sectors.

► **Objectives:** These BEMPs aim at inspiring telecommunications and ICT services companies to develop and deploy new solutions, but also at proving the environmental benefits of such solutions

5 Greening by ICT

► 5.1 Introduction (2/3)

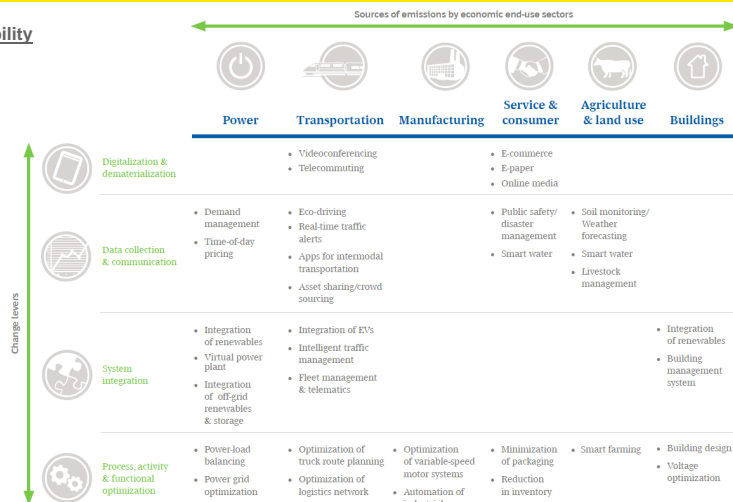
Links between the different solutions



5 Greening by ICT

► 5.1 Introduction (3/3)

Applicability



5 Greening by ICT

► 5.2 Digitalization and dematerialization (1/2)

Main target sectors					
Power	Transport	Manufacturing	Service and consumption	Agriculture	Buildings

Description

- In this BEMP, we refer to **content switching from physical carrier to digital and online file and service**. ICT solutions are central to the dematerialization of a large variety of products and services.
- Such solutions are **helping organisations in any sector improve the efficiency of their activities by saving time and reducing expenses**.
- If these drastic changes have offered opportunities for reducing the environmental impacts of many services, products and activities, a **rebound effect** can be observed with an increased consumption of services, products and activities.

Here is a non-exhaustive list of solutions that have been developed by ICT services providers:

- Video and audio conferencing applications to reduce the needs for business travel.
- ICT solutions to encourage telecommuting.
- E-commerce to reduce retail carbon footprint.
- E-paper and paperless procedures and archive to reduce the use of materials.
- Online media to reduce the use of materials.

5 Greening by ICT

► 5.2 Digitalization and dematerialization (2/2)

Environmental indicators

- (i1) GHG emissions based on the Greenhouse Gas Protocol, scope 3 emissions
- (i2) Number of face to face meetings avoided each year through the use of videoconferencing by clients
- (i3) Share of clients' employees using telecommuting solutions
- (i4) Share of periodical documents completely digitalized (e.g. invoices, administrative documents, journals, etc.) by clients
- (i5) Share of products and services sent online (in terms of turnover) by clients

► Applicability

- ICT services providers can monitor their products and services' environmental performance based on their clients' utilisation and performance. ICT services providers have to collect data from their clients to assess the implementation of their solutions.

Page 77

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

5 Greening by ICT

► 5.3 Data collection and communication (1/2)

Main target sectors

Power

Transport

Manufacturing

Service and consumption

Agriculture

Buildings

Description

- Such solutions help companies reduce their environmental impacts by reducing consumption of resources (energy, water, materials) through:
 1. **data collection with smart sensors** (on networks such as electrical grid and telecommunication network, roads, pipes, etc.);
 2. data aggregation, analyse and display of data in a **monitoring dashboard** (through adapted software);
 3. **real-time communication**, for better decision making and improve process efficiency.

- ICT technologies can be used in very different sectors and for various activities. They have to cover a large scope of the operations at a site level or at a company level to ensure global performance analysis.

Are presented below a non-exhaustive list of data collection systems solutions that have been developed by ICT services providers:

- Energy demand management and time-of-day pricing
- Real-time traffic alerts, applications for intermodal transportation and eco-driving
- Smart water systems
- Soil monitoring and livestock management

Page 78

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

5 Greening by ICT

► 5.3 Data collection and communication (2/2)

Environmental indicators

- (i1) GHG emissions based on the Greenhouse Gas Protocol, scope 3 emissions
- (i2) Annual energy savings (kWh) of clients
- (i3) Annual water consumption savings (m3) of clients
- (i4) Annual reduction of consumables of clients
- (i5) Number of smart meters connected at clients' place

► Applicability

- ICT services providers can monitor their products and services' environmental performance based on their clients' utilisation and performance. ICT services providers have to collect data from their clients to assess the implementation of their solutions.

Page 79

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

5 Greening by ICT

► 5.4 System integration (1/2)

Main target sectors

Power

Transport

Manufacturing

Service and consumption

Agriculture

Buildings

Description

- With the growing urbanization, the increase of the mobility and broader access to Internet, cities need to improve their efficiency and transform into smart cities. **Smart cities** designate a process whereby technology providers offer technical solutions to contribute to the integration of infrastructures and services (energy grid, roads, buildings...).
- ICT technologies help **connect the various systems in an integrated and dynamic system** and reduce environmental impacts by reducing energy consumption and the use of resources. ICT services providers created adapted **software to gather and analyse different types of information coming from different sources to improve management processes**.

- They can be used by public authorities or private operators managing public infrastructures or at companies' level to improve the management of their own infrastructures.

Presented below is a non-exhaustive list of system integration solutions that have been developed by ICT services providers.

- Integration of renewables on grid or off-grid
- Integration of EV's
- Fleet and traffic management
- Building management system

Page 80

© 2016 Property of Ernst & Young et Associés
This presentation, reserved for your internal use, is inseparable from the contextual elements used as a basis for its elaboration and from the spoken comments accompanying it.

Final Meeting of the TWG for the EMAS Sectoral Reference Document on BEMP for the Telecommunication and ICT Services Sector

EY

5 Greening by ICT

► 5.4 System integration (2/2)

Environmental indicators

- (i1) GHG emissions based on the Greenhouse Gas Protocol, scope 3 emissions
- (i2) Annual energy savings (kWh) of clients
- (i3) Number of units connected to the grid (number of EVs, wind turbines, etc.) by clients
- (i4) Share of renewable electricity produced by clients integrated on grid

► Applicability

- ICT services providers can monitor their products and services' environmental performance based on their clients' utilisation and performance. ICT services providers have to collect data from their clients to assess the implementation of their solutions.

5 Greening by ICT

► 5.5 Process activity and functional optimization (1/2)

Main target sectors					
Power	Transport	Manufacturing	Service and consumption	Agriculture	Buildings

Description

- **Anticipating or adjusting the production process** has become critical for companies in today's global markets and intensified competition to meet customers' expectations.
- Process activity and functional optimisation designate a large range of solutions that **use intelligent simulation, automation, redesign, or control**. Such solutions aim at **optimising processes, activities, functions or services**.
- The use of functional optimisation and modelling software helps organisations reduce their environmental impacts by: reducing energy consumption, reducing the use of resources and materials, and reducing end-of-life impacts.

Presented below is non-exhaustive list of process activity and functional optimisation solutions that have been developed by ICT services providers:

- Optimisation of truck route planning and logistics network
- Optimisation of variable-speed motor systems and automation of industrial processes
- Minimisation of packaging, use of eco-friendly material and design of products for easy and effective dismantlement
- Reduction of inventory
- Building design
- Food supply chain optimisation

5 Greening by ICT

► 5.5 Process activity and functional optimization (2/2)

Environmental indicators

- (i1) GHG emissions based on the Greenhouse Gas Protocol, scope 3 emissions
- (i2) Annual energy savings (kWh) of clients
- (i3) Amount of material saved (kg) by clients
- (i4) Share of clients' products (€ turnover) using modelling to reduce use of materials

► Applicability

- ICT services providers can monitor their products and services' environmental performance based on their clients' utilisation and performance. ICT services providers have to collect data from their clients to assess the implementation of their solutions.

5 Greening by ICT

► Applicability

Colour			
Cost (initial investment)	High	Medium	Low
Applicability to SME	Not applicable	Applicable with restrictions	Full applicable
Environmental benefit	Low	Significant	High

BEMP	Target group	Cost	Appl. to SMEs	Env. Benef.	Comments
5.2 Digitalization and dematerialization	All companies				These different solutions are developed by different types of telecommunications and ICT services companies, both start-ups and large firms. The development of such solutions may require huge investments.
5.3 Data collection and communication	All companies				
5.4 System integration	All companies				
5.5 Process activity and functional optimisation	All companies				

Annexes



Main changes in the report structure (1/2)

See 1.3

Chapter	BEMPs	Previous BEMPs
Cross-cutting measures	2.2 Making the best use of an environmental management system	6.4. Energy monitoring and management
	2.3 Procurement of sustainable ICT products and services	5.2. Procurement for sustainable equipment 9.3. Establish energy and environmental performance criteria for ICT equipment used by customers
	2.4 Optimising the energy consumption of end-user devices	5.3. Improving the energy efficiency of ICT equipment
	2.5 Use of renewable and low-carbon energy	6.2 Use of alternative energy
	2.6 Waste management of ICT equipment through waste prevention, reuse and recycling	7.2. Improving waste prevention 7.3. Improving WEEE collection, recycling and recovery 9.3. Collect and recover used ICT equipment from customers
Data centres	3.2 BEMPs related to existing data centres 3.2.2 Implement an energy management system for data centres (including measuring, monitoring and management of ICT and other equipment) 3.2.3 Define and implement a data management and storage policy 3.2.4 Improve airflow management and design 3.2.5 Improve cooling management 3.2.6 Review and adjust temperature and humidity settings	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
	3.3 BEMPs related to selecting and deploying new equipment and services for data centres 3.3.2 Selection and deployment of green equipment for data centres	4.4. Efficient cooling technologies and systems 4.5. Airflow and settings management and reuse of heat
	3.4 BEMPs related to the deployment of new ICT services and software 3.4.2 Developing new ICT services and software minimising servers utilisation	
	3.5 BEMPs related to new build or refurbishment of data centres 3.5.2 Planning of new data centres 3.5.3 Reuse of data centre waste heat 3.5.4 Design of the data centre building and physical layout 3.5.5 Selecting the geographical location of the new data centre 3.5.6 Use of alternative sources of water	4.2. Better locating and planning data centres 4.4. Efficient cooling technologies and systems 4.5. Airflow and settings management and reuse of heat

Main changes in the report structure (2/2)

See 1.5

Chapter	BEMPs	Previous BEMPs
Telecommunication networks	4.2 Improving the management of existing telecommunication networks	3.3. Designing and managing an energy-aware wireless network architecture 3.4 Dynamic traffic optimisation through green routing and radio resource management
	4.3 Improving risk management for electromagnetic fields through assessment and transparency of data	8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks
	4.4 Selecting and deploying more energy-efficient telecommunication network equipment	3.2. Reengineering wired networks for introducing more energy-efficient technologies 6.3. Reducing energy losses due to electricity conversion
	4.5. Installing and upgrading telecommunication networks	
	4.6 Reducing the environmental impacts when building or renovating telecommunication networks	8.2. Reducing the effects of ICT infrastructures on landscape 8.3. Reducing noise and electromagnetic radiations emissions from telecommunication and broadcast networks
	4.7 Minimising data traffic demand through green software	
	5.2 Digitalization and dematerialization	
Improving the energy and environmental performance in other sectors ("greening by ICT")	5.3 Data collection and communication	9.4. Provide services to help reducing other sectors' environmental impacts
	5.4 System integration	
	5.5 Process activity and functional optimisation	



Contacts

Eric MUGNIER
Partner (Project Manager)
Office: +33 1 46 93 78 15
E-mail: eric.mugnier@fr.ey.com

Christophe Abraham
Senior Consultant
Mobile: +33 6 01 45 43 40
E-mail: christophe.abraham@fr.ey.com

