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Contract N°. Specific contract 185/PP/ENT/IMA/12/1110333-Lot 8 implementing FC ENTR/29/PP/FC Lot 2

Final Report

Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014:
Lot 8 - Power Cables
Project report

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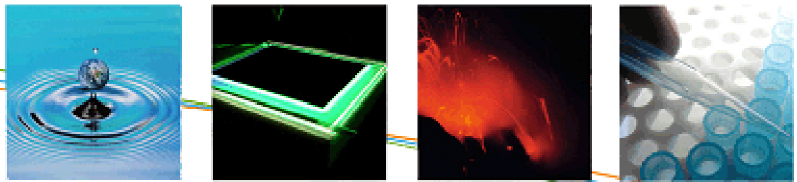

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CHAPTER 1 INTRODUCTION

The underlying report is the MEERP Project Report, serving an administrative purpose vis-à-vis the contract and providing more background on how the preparatory study was conceived and the process to arrive at the results.

Reporting on the study consists of three parts:

1. Final Report, "Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014:Lot 8 - Power Cables, Task 1 -7 report", Specific contract 185/PP/ENT/IMA/12/1110333-Lot 8 implementing FC ENTR/29/PP/FC Lot 2;
2. EcoReports for the different BaseCases which can be consulted on the project website http://erp4cables.net/ ;
3. The excel tool to calculate the Task 7 scenarios;
4. This Project Report, describing the process to arrive at the above results.

The project report answers to the contractual requirements of the service contract and demonstrates that:

- All tasks listed in the MEERP methodology were performed in close consultation with the European Commission and the stakeholders, task results are included in the final report "Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014:Lot 8 - Power Cables, Task 1 -7 report" which is complementary to this report;
- The project website http://erp4cables.net/ was already created to present intermediate and final results for discussion with the stakeholders;
- Three specific stakeholder inquiries were made:
  - one addressed the cable manufacturers to collect market and sales data ;
  - one addressed the electro-installers to collect field data regarding typical electrical installations ;
  - the last one was repeated to collect additional field data regarding typical electrical installations ;
- Data retrieval was also completed by using Eurostat data, personal contacts and personal experience of the team members, on line product catalogues and webshops;
- Two expert-meetings were organized with the Europable association;
- All intermediate task reports have been disseminated in an open and transparent way to the registered stakeholders by means of the website, all received comments were answered and well-considered adjustments were made;
- 95 persons (February 18th ,2015) were registered on the website as a stakeholder and all registered persons agreed with inclusion of their name, company/organization name, and relevant sector in the stakeholder list on the website; they were representing national authorities, sector organisations, cable experts, pressure groups etc.
- A kick-off meeting with a selected group of stakeholders was held in Brussels in the offices of the EC on 8th June 2013;
- Three stakeholder meetings/workshops were held in Brussels in the offices of the EC to discuss draft Task reports :

- the first on the 5th of December 2013 on Draft Task 1-3;
- the second on the 3rd of June 2014 on Draft Task 1-5;
- the third on the 13th of November 2014 on Draft Task 1-7.

- All written comments of stakeholders on the draft Tasks were provided with an answer (see Annex F , 0 and Annex H).

The final report was delivered on the 27th of February 2015.

In line with MEErP EcoReport spreadsheets were completed and a complementary spreadsheet to forecast the EU28 impact from installed cables in different policy scenarios was developed.

This underlying Project Report provides a summary of the study, the minutes of meetings and the presentations; it provides also the comments from stakeholders on the draft documents and the replies of the project team.

CHAPTER 2 CONTACTS WITH THE STAKEHOLDERS

2.1 Website

People could register as a stakeholder on the website and were asked if they wanted to be included in a public stakeholder list. From the 95 persons that were registered, no one expressed the wish not to be displayed on the public list of stakeholders.
The public list of registered stakeholders on the 18th February 2015 and their interests can be found in Annex I .

2.2 Kick-off meeting

A kick-off meeting with a selected group of stakeholders was held in Brussels in the offices of the EC on 8th June 2013. The minutes of the meeting can be found in Annex A . The presentation displayed during this meeting is included in Annex J

2.3 Stakeholder meetings

Three stakeholder meetings were held in Brussels in the offices of the EC:

- 5th of December 2013: First stakeholder meeting in Brussels (minutes see Annex A) on Draft Task 1-3;
- 3rd of June 2014: Second stakeholder meeting / workshop in Brussels (minutes see Annex B) on Draft Task 1-5;
- 13th of November 2014: Final stakeholder meeting / workshop in Brussels (minutes see Annex C) on Draft Task 1-7.

The minutes of these meetings can be found in this project report in the annexes. The presentations that were displayed on these meetings are included in Annex K , Annex L and Annex M .

2.4 Expert meetings and experts consultation

Two meetings with Europacable took place. One meeting at the start of the project, see Annex E Another meeting took place on 13 May 2014 to clarify and discuss the draft Europacables' comments that are in Annex F .

2.5 Consultations in writing

2.5.1 Inquiry

Three specific inquiries were made:

- one was addressed at the cable manufacturers to collect market and sales data ;
- one was addressed at the electro-installers to collect field data regarding typical electrical installations;

- the latter one was repeated to collect additional field data regarding typical electrical installations.

2.5.2 Consultation in writing on draft reports

Comments from stakeholders on draft chapters 1-3 (version 1) and the responses that were given by the project team can be found in Annex F .
Comments from stakeholders on draft chapters 1-3 (version 2) and chapters 4 and 5 (version 1), and responses can be found in 0.
Comments from stakeholders on draft chapters 4 and 5 (version 2) and chapters 6 and 7 (version 1), and responses can be found in Annex H .

2.5.3 Other

The authors also wish to thank the many people that supplied information by e-mail, phone and websites during the elaboration of the draft report. Much of this information is included in the study; consult therefore the reference list in the final report.

CHAPTER 3 CHRONOLOGY

Hereafter is a task per task chronology as executed including publication dates (see Table 3.1):

- 8th June 2013: kick-off meeting in Brussels;
- Execution of tasks 1-3: publication of draft chapters
- 28th October 2013: meeting with Europacable in Brussels
- 5th of December 2013: first stakeholder meeting/workshop in Brussels;
- 13th May 2014: meeting with Europacable in Brussels
- Publication of updated versions of chapters 1-3 after comments from stakeholders and draft chapters 4 and 5;
- 3rd of June 2014: second stakeholder meeting/workshop in Brussels;
- Publication of updated versions of chapters 1-5 after comments from stakeholders and draft chapters 6 and 7;
- 13th of November 2014: third stakeholder meeting/workshop in Brussels;
- Publication of final versions of chapters 1-7 after comments.

Table 3.1: Publication dates

28-06-2013	Kick-off meeting presentation
30-09-2013	questionnaire for cable manufacturers
30-09-2013	questionnaire for installers
13-11-2013	Invitation and preliminary meeting agenda for the first stakeholder meeting
13-11-2013	Notes of VITO - EUROPACABLE meeting held on Monday, 28 October 2013
30-11-2013	Template for Stakeholder Comments
30-11-2013	Task 1 draft document (1st version, outdated)
30-11-2013	Task 2 draft document (1st version, outdated)
30-11-2013	Task 3 draft document (1st version, outdated)
16-12-2013	First stakeholder meeting presentation slides

18-12-2013	Minutes of first stakeholder meeting
19-05-2014	Invitation and meeting agenda for the second stakeholder meeting
26-05-2014	Questions from and answers to stakeholders regarding draft documents Task1-3 (version 1): ECI , Europacable , Viegand Maagoe.
26-05-2014	Task 1 (2nd version) draft document
26-05-2014	Task 2 (2nd version) draft document
26-05-2014	Task 3 (2nd version) draft document
26-05-2014	Task 4 (first version) draft document
28-05-2014	Task 5 (first version) draft document
04-09-2014	Minutes of the second stakeholder meeting
31-10-2014	Second stakeholder meeting presentation slides
31-10-2014	Questions from and answers to stakeholders regarding draft documents Task1-3 (version 2) and Task 4-5 (version 1): ECI , Europacable ,EDF , Nexans Norway.
31-10-2014	Task 1 (3rd version) report
31-10-2014	Task 2 (3rd version) report
31-10-2014	Task 3 (3rd version) report
31-10-2014	Task 4 (2nd version) report
31-10-2014	Task 5 (2nd version) report
31-10-2014	Task 6 (1st version) report
05-11-2014	Task 7 (1st version) report
14-11-2014	Third stakeholder meeting presentation slides
02-2015	Minutes of the third stakeholder meeting

ANNEX A MINUTES KICK-OFF MEETING ON 28TH JUNE 2013

Date :	28/06/2013	Ref.	ETE/N3582/2013-0001
From :	Lust Arnoud, Paul Van Tichelen, Dominic Ectors, Marcel Stevens	Annexe(s):	Presentation
To :			
Copy (CC) :			

Subject : Minutes kick-off meeting Lot 8- Power Cables with the stakeholders, Brussels, Belgium, 28/06/2013 11:30 – 13:00

Present

European Commission:

- Cesar Santos, DG ENTR, Policy Officer, (managing the framework contract)

Contractors:

- Arnoud Lust, framework contract manager, VITO (Belgium)
- Paul Van Tichelen, technical project manager power cables, VITO (Belgium)
- Dominic Ectors, expert power cables, VITO (Belgium)
- Marcel Stevens, expert power cables, VITO (Belgium)

Stakeholders:

- Bernard Gilmont, European Aluminium Association AISBL
- Dr. Volker Wendt, Europacable
- Annette Schermer, Prysmian group
- David Yates, ALCOA
- Helmut Myland, ZVEI, Referent Secretary IEC TC 20/ CLC TC 20
- Fernando Nuno, Copper Alliance

Actions

- Cesar looks for a date and room for the first stakeholder meeting, this will be announced on the project webiste.
- Contractor launches website and informs stakeholders of launch.
- Contractor distributes presented slides (done via these meeting minutes).

Minutes

Cesar:

please ask the difficult questions
We have no pressure to regulate : the burden of proof is upon us.

Paul:

- Please provide us with information (sales,…).

Paul shows the presentation "Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014:Lot 8- Power Cables. Kick-off meeting with stakeholders" (see annex).

Slide 3: EC policy officer & VITO Study Team

Slide 4: Introduction

Cesar:

Preparatory study is 2 years; including a chapter with policy recommendations. This "proto-regulation" is less than 50% of final legal drafting. The contractors deliver policy recommendations. Looking at previous studies like EuPTransformers, about 50 % of the recommendations comes from the contractors, 50 % from the stakeholders.
Then EC starts regulation process, consultations, adoption
In total the regulation process will take about 55 months.

Bernard :

- What is the timing of the study?

Paul:

- The project duration is 20 months. Planning is shown in slide 13.

Cesar:

Any regulatory proposal will be for the next Commission;
Eco-labeling and certain aspects of eco-design will be revised next year. The energy labeling need to be revised heavily. It must be rescaled. High categories are over populated.

Slide 5: MEErP in a nutshell

Cesar:

We are dealing with a simple product. But it gets complicated with the integration in the system. Can one define a labeling system that is independent of its use? For other products like heat pumps it is still more complicated.
Temptation to look at the system, but there is a problem with the directive. The directive is addressed at products, not at system level, because the responsibilities are different.

Volker:

- This discussion about product/system is beyond the project?

Cesar:

It can be looked at in the project: "if the regulation of systems would be allowed under the directive, the following regulations could be proposed …"

Gilmont:

Refers to the EPB Directive, indicating that this directive is looking at the building at system level.

Slide 6: Task 1 Scope

Outdoor power cables : that is a different user group

Cesar:

Discussion on the scope. Two considerations has to be taken into account:

- The possibility to capture energy savings. Untapped potential;
- The absence of regulation

Yates:

- The common understanding is that 'transmission/distribution power cables' and 'power cables in buildings' are two different studies.

Cesar:

- Are overhead cable losses covered by other regulation?

No answer

Gilmont:

- Stick to one study on power cables in buildings as proposed in the working plan.

Everybody agrees with this statement.

Nuno:

- Art. 15 of energy efficiency directive covers distribution systems: watch out for overlap.

Cesar:

- Where do you draw the line? Is the scope clear?
- Needs to be homogeneous;
- Is there an unambiguous understanding?

Yates:

- Refers to the standards mentioned in the working plan. The fixed wiring of electrical installations is described in standards IEC 60227 and 60245.

Myland:

- The design of the cables is depending on the companies, the history. The focus could be close to the end use in buildings (residential, industrial), where the end-use is very clear. Distribution grid is a very different story;

- Not sure that you want the outdoor distribution system in the scope.

Yates:

- Refers to Task 3 of the working plan (page 219).

Myland:

- After the last transformer?

Paul:

- Yes, but also the outdoor cable and hence keeping the distribution company out of scope.

Wendt:

- Refers to certain IEC 60364 : mentions some voltage drop. Also US and Canada regulations.

Myland:

- Are we talking about the cables themselves or the cable system? The cables could be the same inside or outside the building.

Cesar:

- It helps to look at it from the point of view of the market : who is buying the cables? (It works much better in B2C markets. We could come up with 2-3 different labeling systems for different uses.
- We don't have to invent a need. If everything is perfectly clear to the installer, no labeling is needed. The objective of labeling is to give the consumers a choice.

Gilmont:

- You only have your own choice for the cable after the meter. (Also for non-residential applications?)

Cesar:

- For the transformers the professional buyers do their calculations of total cost of ownership : no labeling is needed.

Yates:

- We are just talking about the energy use of the cables?

Cesar:

- Talks about the history of EuP : 16 products. For instance mercury in lamps has been regulated as other environmental aspects like water usage in washing machines. For vacuum cleaners: also material efficiency.
- We need a very clear case if we want to regulate recyclability.

Gilmont:

- Explains the difference between minimum requirements and labeling (superior products).

Cesar:

- The focus is on indoor, low voltage power cables and we check the standards. We stick with that unless otherwise needed.

Cesar:

- Two types of requirements in the eco-design directive.
  Information requirements;
  Minimum requirements
- In the labeling, it is only about information.

Yates:

- Buildings is a total different case as refrigerators. Does the buyer (who pays the energy bill) have any say on the choice of the cables?

Wendt:

- Energy losses in cables will be negligible in comparison with heating, insulation, etc.

Cesar:

- Let the figures speak for themselves;
- Look at labeling schemes in other jurisdictions.

Gilmont:

- There are other labeling approaches than the “fridge approach”.

Myland :

- Stresses the importance of border conditions for safety. If the cable is too big, the selected fuse may not be correct.

Cesar:

- Are the safety standards harmonized across Europe?

Myland :

- Only the time to switch off, not the selection of the diameter.

Cesar:

- Is the understanding of safety harmonized over the EU?

Myland :

- In interpretation yes, in implementation not.

Cesar:

- We could ask the standarisation people to extend the safety standards to energy efficiency.

Wendt:

- Safety has precedence over everything.

Myland :

- At least the safety aspect should be looked at;
- We should be very careful when increasing the cable

Discussion about the role of the fuse.

Wendt.

- Three initial difficulties :

  The inclusion of power cables : what is a power cable? The inclusion of "power cables" in eco-design is wrong. What section of power cables do we think of?

  The methodologies applied for the initial calculation was not very accurate;

  If you put an energy label on a fridge, this is a stand-alone product. This is not the same for cables : you have a whole domino effect. We can't look at the cable in an isolated way.
- Safety is dominant;
- "I've never bought a meter of cable myself". Is this in the spirits of the eco-design directive? We have to move forward very carefully.

Slide 7: Task 2 Market Data

Paul:

- An enquiry will be sent to the stakeholder to collect information (sales figures,…).

Slide 8: Task 3 Users
Slide 9: Country specific differences DIN vs AREI :

Paul:

- Comparison between : F, BE, DE
- In Germany the diameter is dependent of the length.
- Neutral and earthing wires are combined in some countries.
- Installation codes are not harmonized and they are not based on losses (based on safety). The installers follow those codes.

Slide 10: Task 4 Technologies
Slide 11: Task 5-7
Slide 12: Task 7 Scenarios

Cesar:

- In the end the Commission will have to undergo Impact Assessment. If the study concludes there are not enough benefits, there will be not regulation.
- Role of the contractor is to collect all info from the stakeholders.

Gilmont:

- Sensitivity analysis : refurbishment rate of 3% is too optimistic (also important for other building materials). This could be a way to go: impose refurbishment rates.

Slide 13: Planning (preliminary)

Planning (preliminary)

3 Jun 2013 ■ Starting date
28 Jun 2013 ■ Project kick-off meeting with EC
mid Jul 2013 ■ Launch website www.erp4cables.net
End Aug 2013 ■ Launch first series of enquiries to registered stakeholders
End Nov 2013 ■ 1st stakeholder meeting on Draft Task 1-3
End May 2014 ■ 2nd stakeholder meeting on Draft Task 1-5
Early Nov 2014 ■ 3rd stakeholder meeting on Draft Task 1-7
End Feb 2015 ■ Publication Draft Final Report Task 1-7

Wendt:

- Is the website public?

Paul:

- Yes, it will be public. It will be launched mid July 2013. We want you to register.

Cesar:

- Contractor must have a “feedback log”.

Paul:

- Yes, there will be ‘a possibility to comment formally on draft reports’ (procedure will be explained on the website when those reports are released). Please note that comments are not anonymous and will be included in the final project report .

Wendt:

- First question is the scope. Will there be a consultation on this?

Cesar:

- Contractor makes a proposal
- Will be subject to consultation by enquiries

Gilmont:

- In any case, everything is public.

Cesar:

- Circulate the reports 4 weeks before the meeting
- The timing (4 weeks) has to be discussed.

Yates:

- There is a definition of the product group in the study in preparation of the working plan. If you deviate from that, you need to submit it for consultation to the stakeholders.

Cesar:

- This is just a working definition, this is not binding. It can be redefined.

Paul:

- Consultation is needed with CENELEC to check that the definition fits with standards.

The presentation will be distributed to the participants.

Slide 14: Conclusion

Not shown due to timing constraints.

ANNEX B MINUTES 1ST STAKEHOLDER MEETING ON 5TH DECEMBER 2013

Datum :	5/12/2013	Ref.	2013/TEM/1364 (draft)
Van :	Karolien Peeters	Bijlage(n) :	PPT presentation
Aan :	Cesar Santos; Stakeholders		
Kopie ::	Paul Van Tichelen, Dominic Ectors, Marcel Stevens, Arnoud Lust		

Betreft :

Minutes of 1st stakeholder meeting on potential Ecodesign/Labelling Requirements for Power Cables

BREY Building, Brussels, Belgium, 05/12/2013

Present

European Commission		
DG Enterprise	Cesar Santos	CS
Project Team		
VITO	Paul Van Tichelen	PT
VITO	Dominic Ectors	DE
VITO	Marcel Stevens	MS
VITO	Karolien Peeters	KP
Stakeholders		
Copper Alliance	Fernando Nuno Gonzalez	FN
Viegand Maagoe	Anne Svendsen	AS
European Aluminium Association AISBL	Bernard Gilmont	BG
Nexans (and Europacable)	Friedrich Müller	FM
EDF	Maud Franchet	MF
Fachverband Kabel und isolierte Draehte	Helmut Myland	HM
University of Bergamo	Angelo Baggini	AB
CLASP	Marie Baton	MB

Objective of the meeting

Stakeholder consultation in the framework of a study with regard to **Ecodesign of Power Cables** (Lot 8) accomplished under the authority of DG Enterprise of the European Commission (EC), under specific contract No 185/PP/ENT/IMA/12/1110333-Lot 8, within the multiple framework service contract No FC ENTR/M29/PP/FC Lot 2, preparatory studies and related technical assistance on specific product groups.

Discussion on the interim report for task 1, 2 and 3.

Agenda

- Welcome;
- Short presentation of participants;
- Introduction to MEErP and the ErP directive;
- Presentation of draft Task reports 1-3;
- Presentation of first screening;
- Enquiry results;
- Break & Lunch;
- Discussion on scope;
- Answers to questions received in writing before the meeting;
- Other Q&A;
- Further needs for data provisions and/or enquiries;
- Closure.

Minutes

Short presentation of participants (all)

Introduction to MEErP and the ErP directive (PT)

The tasks in the MEErP methodology are interrelated. We will discuss today the first three tasks which are on collecting data and evidence. It are typically tasks with data, not with conclusions.
The first three tasks can be downloaded from the website. They are not final, but give an idea and help you to assist us with the data. If you have data available, please share them with us. If it concerns confidential data, we will aggregate them and can sign an NDA.
The different MEErP tasks were explained (see powerpoint presentation in annex and project website).

Name	Comment/Answer
FM	Question on the scope: The focus is on power cables installed in in buildings. It will be important to see the power cable in the installation and the way it is used. The way of installation influences the losses. Is the way of installation also included?
PVT	Answer will be given in task 3 dealing with system aspects.
FM	Does ‘buildings’ covers all buildings, including special buildings like power plants? There is no clear definition of the meaning of ‘building’.
PVT	This is a problem that we also faced. There will be side cases which we need to report in task 7 (impact). Basically we focus on indoor cables, but the same cable can be used in a power plant. We need to look at this at the end of the study. We have no clear answer yet, but we are aware of the problem.
CS	Reflection about the terminology: in Ecodesign context, the scope refers to the product itself. The scope is the cable itself, not the losses. The scope has to refer to a specific case. (Remove losses from title). The losses is the main significant impact.
PVT	OK we understood the point. We need to look at this at the end. The scope might be to broad or to narrow.

The project planning was presented (PVT), see powerpoint in annex/website.

Presentation of draft Task reports 1-3

Task 1 (PVT)

We proposed in the screening to focus on installed power cables and wires in buildings (residential and non-residential) AND cables and wires behind the electrical meter. Cables installed behind the meter are out of the control of the utilities. Moreover we focus on indoor cables. Outdoor cables are also seen as other product groups.
Not taken into account are cables on distribution level. We see this as another business with other stakeholders.

Product scope:

We will look at an installed cable, an electrical circuit. It is not possible to look at the cable alone, we have to look at the application. In MEErP terminology the cable is the product that is brought on the market by the installer. He introduces this in an electrical circuit which has an impact on the losses. We will look at the cable as a functional element. The first intention is not to have all data on circuit breakers. We will for example not ask the bill of the material of the circuit breaker, this will be simplified.

Product?

- Prodcom:

NACE 27321380:"Other electric conductors, for a voltage < 1000V, not fitted with connectors"
Too broad because it also covers other cables. The statistics in prodcom are higher than what we have in our model.

- Standards/Designation codes:

Every country has its specific designation for cables. The table on slide 19 should be verified and completed by the stakeholders. If there is something missing in this table, please let us know.

- Other possibilities:

Field of application: for example cables installed in lighting circuit – we will introduce application oriented categories.

Product performance parameters (PVT)

Primary performance parameter: "current-carrying capacity" of the cable/conductor [Amperes]

Another approach could be the losses, but this is not the function of the cable. If there are other opinions, comments are welcome.
Secondary performance parameters: cross sectional area, DC resistance, construction parameters and use parameters. We will look to were the cable is installed and how to model the impact of the cable.

Measurement and test standards (MS)

EN 60228 and EN 50395 are the most important standards for conductors and cables.
HD 60364-5-52 is the most important for electrical installation. Contains correction factors and maximum voltage drop.
IEC 60287-3-2: Economic optimisation is defined in this standard.
IEC 60228: Measurement of resistance. Accuracy of the measurement equipment is not included. Stakeholders informed us that this is defined in another standard. We still need to check this standard.

Legislation (MS)

- Directives applicable to LV cables:
    - Low voltage Directive
    - RoHs directive
    - Cable must be marked with CE and/or HAR mark
    - Construction Products Regulation (EU) No 305/2011 (CPR) – work in progress
    - Are there other directives applicable: please provide input.
- Member state level legislation

  - This work is not complete yet. If you have more information available, please provide
- Third country legislation:
  - Information is still missing – please provide

Presentation of first screening (DE)

Objective: Check the appropriateness of the chosen product for Ecodesign measures. The following conditions are mentioned in the Ecodesign directive:

1. The product shall represent a significant impact on the environment;
2. The product shall represent a significant potential for improvement;
3. The product shall represent a significant trades and sales volume.

1: Significant impact on the environment?

We looked at the circuit level because we need to look at a broader scope than the cable. For this screening we defined 4 types of circuit categories for 3 sectors (residential, services, industry) which are used throughout this screening step.

- circuit level 1 (also called distribution circuit): distribution from main board to sub distribution board
- lighting circuit;
- socket outlet circuit;
- dedicated circuit, serving one or more heavy loads.

We started for this first screening from the analysis included in the Ecodesign working plan and reviewed it. In this study annual sales and stock data were available.
Losses are directly related to the energy consumption. Overall energy consumption data in buildings is based upon projections made by the European Commission. The calculated losses (loss ration) in power cables in the services sector and industry in the EGEMIN study is about 2%. This figure is used as the overall loss ratio in the working plan analysis.
VITO reviewed this loss ratio by modelling an electrical installation in a residential and a services building.
Residential model: figures are based on enquiry that VITO sent to the installers.
Two formulas are used to calculate loss ratio. The formulas will be elaborated more in task 3.
The formula based on Iavg gives the lowest losses. Losses are proportional to the square. There are many possible approaches.
Residential model: Losses are for this model 0.24% or 0.15%.Services model: 2.26% of losses.
Industry: alternative approach is used (no specific model), but looked at the design methodology, primarily based on maximum voltage drop. (1% - 8 %)

2: Improvement potential

In the working plan 4 improvement strategies, based upon cross sectional area increase, were calculated:

- S+1: one size up
- S+2: two sizes up
- Economic strategy: optimized on minimum cost (investment and losses)
- Carbon strategy: optimized on minimum CO2 emission

Results of the working plan: 45% of buildings according to the new improvement scenario in 2030 results in annual savings of 20 TWh.
In the review of the improvement potential VITO looked at the physical parameters and calculated the improvement potential for a S+x strategy. For instance a S+1 strategy will result in reduction of the losses in between 17% and 40%, depending on

the used CSAs in the electrical installation. The 2 percent used in the working plan is similar to a combination of S+2 and S+3 scenario.
OUR FINDINGS:
Residential sector: 0.3% losses
Services and Industry: 2% losses.
In total savings will be in between 3.77 and 8.88 TWh/year in case of a S+1 strategy, and in between 7.32 and 13.98 TWh/year. The difference when excluding residential buildings is small.

CONCLUSION:
Yes, there is significant environmental impact
Yes, there is potential for improvement: for instance using a S+1 or S+2 strategy.
This is a first screening. The only thing that we can conclude at the moment is that the residential sector is not important. Of course we can discuss on the existing stock. In new installations there is not much to improve over Business as Usual.

Name	**Comment/Answer**
AS	For which kind of buildings is this 3%, industry or…. Are these your figures?
DE	For the total number of buildings. These are the working plan figures. This is what we used in the first screening. In other task we used other figures. We had for example a figure of 12% renovation rate for industry and 1% for residential buildings.
FM	Could you explain in more detail why you used another model for industrial buildings. What is the reason for this and how did you came to the figures for industrial buildings?
PVT	It is simple and in line with the working plan, not much further. With the argument that we had, there is a significant potential. A more detailed analysis will be in the subsequent tasks..
FM	Is it allowed to calculate with the maximum allowed voltage drop?
PVT	Indeed we are aware that it is in between the 50%. We will collect more data in the next task. In the categories that we not exclude they should be raised at the end of the study. After the first screening we can only say that there is not a significant potential in the residential area..
DE	In industry the situation is more diverse than in the residential and services sector.
FM	What is the reason to use a different approach per sector?
PVT	For example we have average data on lighting circuits – reliable statistical data. For dedicated loads in buildings we should also have more specific data. Socket outlets in the service sector will also be known more or less, because we know the electricity and we can reverse estimate the loading.

3: Significant trade and sales volume
Yes, there is a significant trade and sales volume.
Prodcom: 20128 kT of production with value of 12 billion euro. This category includes more than just low voltage cables in buildings. If we divide by 3 we arrive at the same figures as presented in the working plan.

CONCLUSION TASK 1: Yes there is significant environmental impact (see powerpoint in annex) **Our proposal is to exclude residential buildings from the study.** Of course the losses are calculated when using installations with the practices of today. The losses can be higher in old buildings.

Name	Comment/Answer
FN	Issue: What is the environmental impact of additional material? For copper there is already an assessment in the working plan. But we see that there is a big gap between economic section and environmental section (when we go back to EGEMIN study) in terms of CO_2 emissions. It cost quite low adding more material in terms of CO_2 compared to the savings. If you only look at this aspect, it would allow S+6. But this does not make sense from economic perspective. We are far from the switching point were additional impact in manufacturing compensates for losses.
FN	On the residential sector: It wouldn't make sense for adding sections in new installations. We might be underestimating the losses already taking place in the residential sector, especially in existing buildings. More than 60% of the households are more than 40 years old. There might be a potential in the old installations. For new installations it doesn't make sense to go for upsizing, but maybe there is something in the old installations.
BG	Renovation rate: You use 3%, but the current refurbishment rate is 1% according to Renovate Europe association.
DE	In tasks 3 we mentioned the study you are referring to, but other studies mention much higher rates. Certainly for non-residential.
BG	If we would have 3% I would be very happy, but we are very far from that.
BG	Legislation: Do you mean the construction products regulation (slide 25)?
MS	Yes we will correct this.
CS	I want to stay on the 3.5 TWh figure which are the losses for residential a little longer. I want to ask the colleagues if anyone challenges this figure. It is important. If this is the case, it is indeed a candidate for excluding from the scope.
AS	We are assuming that we have a loss when we have a consumption. The more energy efficient equipment we get, the lower the consumption will be and the lower the loss will be. Have you taken that into account?
DE	Yes. Actually it is the end consumption and it is based on projection of the European Commission.
AS	We only have losses when we have consumption. Has a time factor been taken into account?
DE	Yes. This has been taken into account in task 3. The formula about the load profile and load form factor.
FM	You consider full electricity consumption. Is it not the case that for specific circuits the loads is going lower? Because of development of more economic equipment, lighting is changing to led. Have you taken this into consideration?
DE	Than you assume that there are more circuits. Total energy consumption is still going up
PVT	For being clear, this first screening is a simple approach and more details will be elaborated in later tasks. Scenarios are more or less stable, but we can in sensitivity analyses take this into account.
CS	AS raises a very valid point. Household appliances may become more efficient (partly due to Ecodesign). Is it more cost effective to make electricity installations more efficient or make household appliances more efficient? This is probably beyond the scope of this study.
PVT	Indeed, but not completely..
CS	I want to know the feeling of the group towards the proposal of excluding residential buildings. Is this a good idea or not?
FN	Before excluding I would further asses the level of losses as an average in the household. 60% of very old installations might have higher losses than the new installations. The residential sector probably needs different policy measures than industrial and services, but there might be relevant potential in

	the residential buildings which could be addressed through renovation programs or so.
AB	There is a dualism between product and installation. If we can address the problem just by the way of installation, Ok we can exclude. But if we have to take into account also the product perspective product are the same in residential or other category of buildings. So the same product in the European market has to follow two different roads if it will be installed here or there. Is this an issue or not?
PVT	It can be an issue.
FM	We have already today the situation that the same product installed in residential and industrial have different losses. It is not the product, but the way we use it and the application. We may need to address residential buildings as well, but it goes in another direction. If you want an improvement in the residential sector, you have to push for higher renovation rate, while here we are pushing for larger cross sections. Two different directions. Can we cover both directions in this study?
PVT	Indeed. The problem is even more complex, because similar cables are also used inside machinery.
CS	In principle Ecodesign requirements have to be independent of the application of the product. Secondly placing the product on the market. This is a complication of the discussion.

Task 2: Markets

See powerpoint presentation in Annex.

Task 3 Users

See powerpoint presentation in Annex.

Name	**Comment/Answer**
FM	This comment may be a question of definition. If you say recycling of copper, all the copper from all cables will be recycled, not only 95%.
PVT	Yes, we need to adapt our wording in the slide 76. We should make assumptions on the cable and make assumptions on the cable process later on.
CS	In certain member states the theft of cables is quite substantial. Will this be recycling or disposal?
PVT	Indeed it can have an impact, but basically the material is brought to scrap merchant. We will not consider stolen goods as reuse.
BG	It will be recycled.
BG	5% disposal of aluminium. This is not because aluminium wires end up in landfill but because of oxidation losses, depending on recycling process.
FN	We will try to find out sources with information on recycled content. There are some figures on ratios between consumption and recycling of materials. In Europe above 40% recycling rate. It is however difficult to track where the materials come from: motors,…
BG	We are talking here about the recycled content. It will be a lower percentage than 95%. The best standard where both (recycled content and recyclability) are separated is the EN15804. Two things happen at different point in time (respectively beginning of life cycle and end of life cycle).
PVT	These are assumptions for what will happen in 40 years, so at the end of life of the products that are today put on the market. We assumed of course that the situation will not be worse than today.

Enquiry results ()

Not discussed.

Discussion on scope (PVT)

Two important points noted for discussion:
1: The same cable can be found in other applications, used outside the defined scope (machinery…)

Name	Comment/Answer
HM	We have to note cables are used inside applications. We should be clear that we do not consider the cables and the insulated wires in applications. Those are covered by the applications. There is a lot of legislation on this and are therefore covered.
PVT	Indeed.
HM	The application exists on its own, it includes the cables inside. It might be helpful to be very clear, never speak about connection equipment in installations.
PVT	OK
FM	For fixed installations in the sense that it is for supply of energy in the building.
PVT	There remains a grey area: for example cables in a nuclear power plant, is this a building? The cable can also be in a partially indoor/outdoor area? We have to be careful with industrial applications. The scope is clear for us: connected to an application inside the building but there might remain a grey area.
MF	How will wind turbines be considered?
PVT	They are also regulated. We consider this the same as equipment, it is an electrical machine.

2: Residential: Do we exclude them from the scope?
We will of course come back to this in task 7, but if we exclude them, we will not collect much more data.

Name	Comment/Answer
AS	Suggest to take into account the comments that if we don't see a big energy saving potential we should not proceed in this area. But there may be a big potential in existing old buildings which we may miss. This should be mentioned that there probably is a big potential, but for the moment I suggest not take into account residential buildings.
PVT	Could also be studied together with complete renovation, including insulation of the building. Losses in power cables are a very narrow reason to reconstruct or renovate a house.
AS	When you come to energy labelling part it is for product.
CS	Given that the resource for project are limited. If we exclude residential, this will allow to go deeper into industrial and services?
PVT	Good suggestion. We can take up this part in task 7. We can mention that this should be looked at in the EPBD.
FN	Point of old residential installations: there are some schemes already implemented in some countries. In France there is a compulsory revision of electrical installation that is older than 15 years. This can be a vehicle for renovation. But I can agree that this is far out of Ecodesign spirit. Just to note that there is something, but this is another study.
FM	An interesting aspect, this is very efficient what we see in France. Should we propose such measurements under the head of Ecodesing?
CS	Certainly not Ecodesign.

AB	Why just AC application and not DC application? Why just low voltage?
PVT	There are studies for having more DCs in buildings, but this is not a mainstream application.
AB	But it is increasing for example because of PV.
PVT	We can mention this as best available technology in the next task. But this is before the inverter. This goes up to very complex discussions. There can always be side applications. But this is outside the scope.
AB	Not power cable, just signal cable.
PVT	We have to always be careful, certainly when it comes to the point of legislation. Is this a loophole or not? I don't think it will become a loophole. We can add more examples to the list: PV, cable between motor ad inverter in industry.
AB	Did we exclude medium and high voltage because we know that losses are negligible inside building?
PVT	Medium voltage is excluded because it is another stakeholder group. (distribution system operators). Practices and use are different.
AB	But in industrial buildings we distribute medium voltage.
PVT	We consider this mostly outdoor, between buildings. Not inside the building.
AB	It is inside in my opinion. In the big building for sure the internal distribution should be medium voltage.
PVT	We also said 'behind the meter', meaning the user side, not the grid side. Our focus is clearly on low voltage. We maybe miss a very narrow area.
HM	In the kick-off meeting we talked about 'there is no further transformer in the system'.
CS	Good idea. Not after the meter but after the last transformer.
AS	I suggest to keep the definition 'from energy meter'. From the meter on it's the people we can perhaps influence this.
PVT	AND: 'after the meter' and 'after the last transformer' Note: the location of the meter depends on the country.
AS	Normally the supply company owns the cable on the other side. They would replace the cable if they see an interest in this.
PVT	This is indeed the policy part. I suggest we do: And: after the meter And: no transformer involved And: the mains voltage is low voltage
BG	Aluminium inside buildings is not used according to members in Europe. I am waiting on a more documented input and will provide. Aluminium below 3.5 mm is not produced. The production process does not allow this.
DE	Enquiry: two installers mentioned that they were using aluminium inside buildings.
BG	Can you provide this information so I can challenge my members.

3: Other topics?

Name	**Comment/Answer**
PVT	Labour cost differs more over Europe than cable cost. We can take the copper price as a parameter and take it into account in a sensitivity analysis. Outcome will be a big cloud of results. We will collect as much as possible data. Maybe we can look at the copper price used in the transformer study.

Answers to questions received in writing before the meeting – from Copper institute (PVT)

The time frame for comments is 15th of January. Please use the form we provided. You can also give specific ideas in 'proposed change' column. You can even provide the exact wording that you want us to use in the report. We will reply to the comments after the 15th of January.
See document later available on the website with all received stakeholder comments, the remarks discussed in the meeting will be taken into account.

Other Q&A (All)

Any other remarks?

Name	Comment/Answer
FM	Improved efficient use of resources in Ecodesign. The environmental impacts of bigger cables, do you intend to add them? Or is this more something for task 5.
PVT	Yes in Task 5. We will use a simplified LCA. There are 7 important parameters, not only global warming potential.
FM	In the document one you have different scenarios S+1, S+2, eco, environmental. What are the criteria for the last two scenarios.
DE	Based on working plan. It was based on the EGIMIN study.
FM	Is it only taking into consideration the additional cost of the cable or of the full installation?
FN	The economic scenario consists on taking 10 years horizon. Every cable has a price, which is the price used by EGIMIN. The balance is found within this 10 years. It includes the cost of the installation. Environmental section makes the trade of in terms of CO_2 only. Not really representative because much bigger sections.
PVT	Is the report publicly available?
FN	I will check if we can share the report. The study was based on 4 typical buildings. Extrapolation was done on basis of those 4 scenarios. The approach of VITO leads to compatible results.
MB	We spoke a lot about the cross section. Could the study lead to recommendations about the way cables are installed or laid?
PVT	Yes this is possible. We also see that topology is also a saving option. This can also be a recommendation.
AB	Topology can affect the efficiency, but for us this is out of the scope, because it is related to the building design.
PVT	Indeed outside the scope. But it is possible that we give some recommendations here. Recommendation can be that this should be taken in the design stage (integral approach).
CS	We wouldn't do a regulation just to have a recommendations. There are two types for Ecodesign requirements: 1. Minimum requirements for the given environmental aspect; 2. Product information requirements normally to inform purchasers or for example to facilitate recycling. In no case we would have a regulation only with recommendations.

Further needs for data provisions and/or enquiries ()

The most needed data is a cost model for installation.

We will contact the installers because they are not present here. We should know how the tenders are made per point of connections, per running meter.

Name	Comment/Answer
FN	Do you need the cost for labour?
PVT	Yes, how much time is needed to install a circuit, e.g. per meter.
MB	If the cable is more heavy there are also costs coming from the transport.
PVT	This is often foreseen in the cable price. Most of the installers must have such a cost model?
MS	For larger cable you also need a larger conduct.
MB	When will the scope be definitively defined?
PVT	The last day of the study.

Comments that you send to us are public.

Closure (PVT)

Date of the next stakeholder meeting:
Mid may of early june: week of the 19th of May, subject to availability of meeting rooms.

ANNEX C MINUTES 2ND STAKEHOLDER MEETING ON 3RD JUNE 2014

Date :	3/06/2014	Ref.	Final version
From :	Wai Chung Lam	Annex(es) :	- Presentation 2nd stakeholder meeting. - Draft reports Task 1 – Task 5 (see documents on www.erp4cables.net)
To :	Cesar Santos; ENTR Lot 8 Stakeholders		
Copy (CC) :	Paul Van Tichelen, Dominic Ectors, Marcel Stevens, Arnoud Lust		

Minutes of 2nd stakeholder meeting for the preparatory study Lot 8 on Ecodesign for Power Cables

BREY Building, Brussels, June 3, 2014

Present	*Name*	*abbr.*
European Commission		
DG Enterprise	Cesar Santos	CS
Project Team		
VITO	Paul Van Tichelen	PVT
VITO	Dominic Ectors	DE
VITO	Marcel Stevens	MS
VITO	Wai Chung Lam	WL
Stakeholders		
Schneider Electric	Jacques Peronnet	JP
IGNES	Emmanuel Petit	EP
Deutsche Energie-Agentur GmbH	Rafael Noster	RN
EDF	Maud Franchet	MF
BAM (German Federal Institute for Materials Research and Testing)	Daniel Hinchliffe	DH
AIE (European association of electrical contractors)	Evelyne Schellekens	ES
CENELEC TC20	Helmut Myland	HM
Nexans / Europacable	Sophie Barbeau	SB
Prysmian / Europacable	Stefano Luciano	SL

ECOS (European Environmental Citizens' Organisation for Standardisation)	Stamatis Sivitos	SS
European Aluminium Association AISBL	Bernard Gilmont	BG (only in the morning)
OVAM (Public Waste Agency of Flanders)	Marc Leemans	ML
ECD (Engineering Consulting and Design)	Franco Bua	FB
ECI (European Copper Institute)	Fernando Nuno	FN

Objective of the meeting

Stakeholder consultation in the framework of a study with regard to Ecodesign of Power Cables (Lot 8) accomplished under the authority of DG Enterprise of the European Commission (EC), under specific contract No 185/PP/ENT/IMA/12/1110333-Lot 8, within the multiple framework service contract No FC ENTR/M29/PP/FC Lot 2, preparatory studies and related technical assistance on specific product groups.

The main objective was to discuss the technical aspects related to the study (Task 1-5 reports) and to present the next steps of the analysis.

Agenda

- Welcome
- Short presentation of participants
- Short overview MEErP
- Presentation of draft Task reports 1-5, including: updates, questions & answers, discussion
- Break &lunch
- Data gaps identified to complete the study
- Discussion on approach to fill data gaps and the potential launch of a new enquiry
- Any other business
- Planning and Closure

Minutes

- **Short presentation of participants (all)**

After all participants presented themselves, CS shared some observations to inform the discussions. It is time to think what kind of potential requirements like Ecodesign, labelling, or if any, we want to propose for this product group. We have the benefit of last week's adoption of the transformer regulation. CS has followed the transformer discussion closely and what he observed is that at some point in time the stakeholders were able to agree on representative load factors of transformers; which enabled the discussion on what we mean with energy efficiency and to calculate efficiency levels that are economically justified. This is better for regulation and the standard.
With this in mind, CS sees that the main difficulty in this preparatory study of this product group is to crack the similar discussion on what we mean as the energy efficiency of a cable, and what representative usage patterns or load factors are of indoor electrical installations. The way we eventually are going to characterise the energy efficiency will always benefit some but also penalise others. CS role in this discussion is therefore from a regulatory perspective. Before we even are considering mandatory requirements, CS wants to see an acceptance and agreement among the stakeholders of what representative load factors are for different types of installation. CS has not seen that yet. With hindsight of the discussion on transformers, CS sees

that stakeholder's agreement is the key element to make progress towards characterising energy efficiency factors for power cables.

- **Short overview MEErP (PVT)**

See PowerPoint presentation of the meeting and general information available on the project website: www.erp4cables.net

abbr.	Comment/answer
CS	As a reminder: in almost all of the Ecodesign regulations that are adopted so far, the observed principle was that the requirements are independent of the use of the device. This has enormous implications for cables. The way that the Ecodesign methodology works is that abstractions are made from the reality, called base cases, which are representatives of models that are used in the market and with to do economic modelling. In order to come up with requirements that are economically justified. But in the end, the requirements are independent of the final intended use of the product, whether we are talking about transformers, fridges or motors. For cables in CS opinion, this constitutes an enormous difficulty because of the wide heterogeneity in how cables are used and the different load factors.
PVT	Agrees with CS and thinks that this was in any other products. For example lighting products, if an incandescent lamp is not used, it might have a lower impact compared to a LED or CFL lamp that is used. Therefore, assumptions on averages are necessary and we have made the assumption that products are sold for being used. Upon that, averages on the use of a product are connected, and upon that again connections with regulation. For cables the dilemma exist of discontinuous use and cables for e.g. emergency lines. But one big difference for cables compared to other products is that cable products are straight forward to model in use and the choices in type of cables are limited to size of the cable.
MF	Q: Does this mean that the model will be the same for cables of a power plant, lighting cables and other cables?
PVT	A: Yes, but we will discuss whether we want to have more base cases. However, the first principal is to keep it as simple as possible. And the second, if we think we can make it more complex for our measures, we will incorporate it. The first exercise we now have done is with 5 base cases. But already based on our first outcome [see Task 1 report], we think that we need more base cases. The question how much more base cases do we need.

Regarding the planning, it is important that there is an agreement on the methods and approaches, and how we can collect more data. We also saw that we had imprecise calculations, so every suggestion on realistic timing to provide us with data for the later tasks, the scenarios, is important. The current outcomes maybe are not the outcomes you want, but please let us also know where we can collect the data and what we need to do for the data. Data collection is important, so any suggestion is welcome.

- **Presentation of draft Task reports 1-5, including: updates, questions & answers, discussion (PVT/MS/DE)**

The objective of this part of the presentation was to see which input and method is used; what the Ecoreport tool is; what the crucial factors are, and what the impact of those factors is, for example the load factors and stock have big impacts. The load factors must not be overestimated, because the losses in cables will then be bigger than the known electricity production in Europe could justify. We must be realistic in over- or understating factors, which is an exercise we already have done. At the end of Task 5, crosschecks of the data sources of Task 2 were done which lead to the finding that the losses in the cable were too unrealistic high. For which several reasons can be given, one of which is the load factor; but also the stock, the formulated base cases, and the imprecision of the model. This problem must be solved in the given method. Main uncertainty is on the load factors.

Task 1 (PVT)

We consider the cable as a system with a circuit breaker. We look at the installation at system level. Therefore, the circuit breaker will not be looked into for improving the efficiency of it; we only take into account that there is one. However, if one will say that there is improvement potential of the circuit breaker, another study needs to be done.
See PowerPoint presentation of the meeting and draft Task 1 report available on the project website: www.erp4cables.net

abbr.	Comment/answer
JP	Q regarding the scope: is only AC current in the scope, and not DC current?
PVT	A: We will come back on it later in Task 4. We have seen that DC current comes more in important with photovoltaic panels and people want to use it more at their home. It is important to know what is brought on the future market. Maybe in an extreme case there will be only a DC circuit in homes.
JP	Q: But is DC included in the scope or not? As it is not improved.
PVT	A: I need to think about, because it is after the meter and it is for the power distribution. There is one line in Task 4, where it is mentioned as Best Not yet Available Technology.
JP	Q: Ok, but is it in your scope or not?
PVT	A: It is in the scope for the improvement potential, not for the Business As Usual. We have too few evidence that there is DC, apart from some photovoltaic panels on some houses. So it is in the scope of Task 4. But if you have information on what is ongoing on standardisation of DC, it is welcome. We have seen that the US is working on standardisation of DC in houses.
JP	We don't say that it is … we could have some circuit breakers in DC. Is DC considered or not considered in the scope? But I don't need the answer right now.
PVT	We are thinking about it, so if you have a vision on that it is welcome.
JP	You have to clarify it.
PVT	So DC is in our radar, but it is very difficult to treat it the same as AC. The onset was the improvement in AC. Of course, we hear from people that DC is better.
JP	If you are considering load factors, I do not see the difference between AC and DC.
PVT	No, but for the safety, people say you can go to a higher voltage level and the current is lower in the same cable
JP	Exactly, we say 1,000 V AC or 1.5 kV for DC. That is the equivalent, what is the limit of low voltage volt.
PVT	We will further document it in the next revision of Task 4.

abbr.	Comment/answer
SB	Q: You say that residential is excluded from Task 3 to 6?
PVT	A: Yes, we excluded them for looking for improvement, but not from the scope of the study. Because we think, we cannot find improvement in there. Of course, we need to look backwards in Task 7 if there is no collateral damage in that sector. But our conclusion was that improvement in energy efficiency was not to be looked in that application area. Of course, in Task 2 we have looked at the market data with the residential sector, and in Task 7 when formulating the

	policy measure we will look if the measure will also affect the cable of this application.
SB	Q: But the directive is focused on the product and the cables are used independent of their application. So how could you excluded residential sector, put the directive on the product and expect that it will have an impact on the residential market?
CS	A: It is complicated and my thinking goes the same way like yours. But, in many cases we are talking about products that can be regulated and the directive is the framework of that. I think if we end up regulating anything, it will be the installation itself. I think what Paul is trying to say is that the improvement potential in the residential sector is almost negligible. And that we eventually put them in the regulation of the installation in the professional and commercial sector.
PVT	Complementary, maybe we will also look if changes are needed in the product information.
CS	Then we are faced with a different challenge, because the directive talks about putting into service or placing on the market and this concept becomes instable when we talk about indoor electric installations. So we need to tend to be obliged by the law before we consider any regulation.
PVT	Yes, because the installer makes the installation and that is important. So the question is, is this a tailor made product? We will come to these issues at the end. We first need to so where the improvement potential is and it is important to understand what the method is and what is in- or outside our scope in relation to the tasks.
JP	Another question about the scope: If you speak about electric installation, in this case you do not only consider the cross section of the cable but also the length is a key issue. Once again you cannot play on the product itself.
PVT	Yes, we look at the circuit as described in our reports. As we will present in a later stadium, the improvement potential as such is not for the manufacturer to invent a new cable. It is about the installation with other cables or better cables adapted to the circuit.
JP	I do not want to spend much more time on the scope, but maybe the first thing to improve the scope for the next meeting and add clarification.
PVT	We will also put circuit in our scope.
JP	Add exactly what you are focussing on, what you want to with the scope, and be very clear: is it just on the product, on the cable, or on the installation and on which kind of installation? Please clarify it for the next time.
PVT	Of course, but Task 1 will always remain conform Task 1 of the method, but what will be changed and what we already have seen now that we are running in iterative circles in our team, and that there are several currents to be defined. You have the circuit current and the maximum current that the cable can withstand, so in that sense we will define more precisely the types of currents according to the standards. The thing we mainly need to and where we can improve in Task 1 is to define four or five parameters for currents. What also needs to be clarified further is that the installation codes use lower currents compared to the maximum that is allowed fur certain cables by the standards. So if you install a circuit for a certain application according to the standard, the current is always lower than the theoretic maximum current in the cable. But this will not change the calculations much that we have done. In Task 5 we have a table with three or four currents according to different standards and we need to select one. For us the most important current is the rated circuit current.
SB	You say it has no impact on the calculations, but if you consider I_{max}, the

	maximum current carrying capacity, if you change it by the rated current of the circuit, which is lower, than this will change the capacity.
PVT	Yes, of course, we have taken that already into account. But what is more complex is the maximum operational temperature and the percentage of influence by the temperature of the cable, as the situation calculated in the standards is to withstand 90° which is not representative for the real load loss. In real conditions, it is lower and we need to discuss how we can deal with that. But, we take that into account and it is the point of our discussion and the input we collect. So, it is certainly in our scope to take that into account and we are looking into which resistance we should use in our calculations. We think that the one on the maximum temperature is to extreme. At the end we need to be every clear and a sensitivity analysis will be done.
JP	[Remark on slide no. 17:] For me, these parameters, current capacity, are linked with safety and not with energy efficiency.
PVT	No, it is functionality for the end user who wants to connect the load. But our vision is that we should be in function for the end user, why does he wants a cable in his house, and that is to transport energy. Of course, we could have to transport the power. But with the voltage fixed, we can discuss that too. But, we thought that the main thing on the current carrying capacity is the power factor, which is also included in our study. The current carrying capacity was selected because it is functionality for the end user. Cables are not installed for decorations or amusement. So secondary performance parameters are of course important for the product and its functional specifications; e.g. the cross sectional area, the bending area, DC resistance. We will differentiate base cases according to their use, as we know that the load factor is important. So we need to discriminate that. Therefore, we need the parameters.

Please provide us the following information for the sake of completeness:
[Slide no. 19] Measurement & test standards: In the standards, there are no specific targets and no typical load factors.
[Slide no. 20] Legislation: what we can further complete is an overview of the national wiring codes, to illustrate the country specific differences.
[Slide no. 21+22] Can be further defined and if there new insulation materials that are not in the standards yet.

abbr.	Comment/answer
SS	Before moving on to Task 2, may I comment on this conclusion [slide no. 23]. Please take into account that I am stepping in for a colleague and that I was not at the previous meeting. I have quickly gone through the documents and of course, I do not want to add more complexity. I was just looking at the other two criteria apart from the improvement potential for the cables applied in the residential sector and I see that they are a significant amount of the sales and the final energy demand. However, the improvement potential is up to 1 TWh, which is the unspoken threshold of this community if you want. I was just wondering since this was the first screening, is there a possibility that that improvement potential would be higher than that? And if so, we as ECOS would welcome that if that improvement potential is further looked into and taken into account in the other Tasks 3-6.
PVT	Yes, I think it could be. The improvement potential is compared to the current installation codes, so someone who installs everything according to the current regulation will have this low improvement potential. In the existing stock, there might however be an improvement potential if it is renovated according the current regulation. At the end of Task 7, we can mention in a paragraph that during the study it was told that in certain countries there are houses in a poor condition with cables that need renovation. We were also told that in certain

	countries, I thought in France and Belgium, when a house is going to be sold, installations needs to be recertified and old uncompliant installations are forced for renovation. But as told, such a measure is out our scope of this study and different from a situation is where cables are sold and installed.
BG	We had the same problem with windows, that when you enter that segment it eventually will fall under the energy certificate EPBD regulation for renovation. And there the optimization happens for the whole product. We did the same recommendation.
SS	And for new cables that will be put on the market for new buildings? Do you think if the improvement potential will be beyond the 1 TWh?
PVT	No, maybe in certain installation codes per country there are curtain heavy loads that need requirements. So we can compare installation codes of residential homes, maybe there is something small that is overlooked, but we are not aware of that.
SS	Any information you have of what you are stating now can be very useful in the further course, also for in the future. As this is useful information for the Commission to decide whether they proceed or not in any legislative measures. Nevertheless, any of such information should be included in the report, as it is also useful for the stakeholders.
PVT	Therefore, we need the installation codes for Task 1 and in Task 7 we will come back on that by including your comment that there is also improvement potential identified in the existing residential buildings. But of course, this is not the purpose of the complex calculations that we will discuss now. If we will take renovations also on board, this will make the calculations more complex.
CS	Can I just clarify on this non-written rule of thumb of 1 or 2 TWh. It applies on the annual energy savings estimate by 2020 and so let us not confuse the improvement potential with the energy savings estimate. Then you are jumping a bridge, assuming that the regulations would capture all the improvement potential and would translate it into savings. Below 1 or 2 TWh per year of energy savings estimate, the Commission normally does not propose regulation.
PVT	But for 'installations' countries are free to decide as it is different from the EU 'product' regulation.
FN	The problem of savings potential in the residential sector is not between doing something properly and something else properly. The old circuits are not fit for today's consumption patterns. So there might be some improvement potential, but this is a different discussion. It is not by improving the design of the electrical installation but just by updating it to the current standards. This is another topic but if this needs to be added to the picture, further analyses are probably needed. Upgrading the old circuits might make sense for safety and energy savings reasons. But I understand this is a different study and not in the scope of this one. For the residential sector, I think the starting point and findings we are looking for are different.
CS	I think this is a valued comment and there you are really pointing into the direction of the EPBD and retrofitting. The implementation of the EPBD is at national level. At the end of the day, people need standards to know how to make an installation energy efficient. So which every way we look at it, we need a standard to make cables more energy efficient.
PVT	Yes, I agree, at product level we could only request for information related to losses. Currently users/installers are familiar with the Cross-Sectional Area (CSA) as product information but have few awareness and/or information on their losses.

Closing comment on Task 1: It should be clear that the scope of each task is defined by the task and that we look to whole circuit not at the cable alone.

Task 2 (PVT)

The economic data collected is data that the Commission has or what is available in Eurostat and completed with other sources. We look at stock data and sales data. The sales data is important because it tells something about product regulation and what is put on the market. It is important to know that we have found that there is a long lifetime in the residential sector, as the renovation rate is very low. In the industry and service sector, it is much higher. Because of the long lifetime of the product, the sales and stock data needs to be precise for the modelling. Something the stakeholders could improve is the sales data.
See PowerPoint presentation of the meeting and draft Task 2 report available on the project website: www.erp4cables.net

abbr.	Comment/answer
FN	Q: Why is stock data relevant?
PVT	A: It is relevant for the lifetime of the product and at the end in order to make crosschecks. For example, we need to know how many cables are sold that are unloaded due to backup reasons and that the losses are mainly in a few percentages of cables installed. We need to know: what is the stock and what is the loading, because everything is interrelated.
FN	At some point, I would say that the sales figures are more reliable input data that any guess on what is installed. The Prodcom data should be reliable and this guess.
PVT	The two reliable sources are indeed the sales data, if we have it for this product group from the manufacturers, and the energy consumption. These are for use the most important parameters to which we check and fit. This means if the stock is larger but can be fitted to the lifetime of the product and the length of the circuit, then we know the loading. The most reliable figures normally are the energy use and the sales data. Of course, certain stock data should be reliable as well. But at the end, in Task 5 we will do crosschecks in order to see which data is reliable and what can be improved. In this task, we collect data even if it is not reliable. What we have learnt in such studies is that it never fits, there are always inconsistencies, but in the end, we will have realistic data that more or less fits. The view is realistic, but we can discuss about 10-20% more loading, or stock, or a longer lifetime, so there is a certain playing field. But we should start with something realistic from which we can improve further. Some data sources cannot be modified easily, such as the sales data, so we need them more precise.
SB	Q: Is it expected to take into account the impact of the Ecodesign directive and energy consumption that will go into power cables? The purpose is to reduce the energy consumption in Europe with 20%. Meaning the energy that is going through cables should be calculated also. Is this something that will also be taken into account? If you reduce the energy consumption until end of reach, this means the energy that goes into the core, into the cable, will decrease also…?
PVT	Yes and no, I think. In our model we can take certain things into account [see upcoming tasks], but the impact are fixed values in the MEErP methodology. So, a TWh electricity used is a static value. If we go 100% green energy, then our discussion for energy efficiency ends.
DE	There are projections of energy use in Europe in the next 10, 20 years. And these figures are fixed, are already set, with these efficiency measures taken into account. So also, there will be more electrification coming in the next years: you will have electric cars, more heat pumps. So we use the figures that are in the methodology.
SB	Yes, but the base case that you take into account, when you count the installation… in specific the installation… reduce the energy consumption.

PVT	… but for a base case it is not important. When you install a circuit you know the load, when a machine is installed in a factory, that machine will not change and become more efficient during its lifetime.
SB	Yes, but during the production the machine can be changed.
PVT	Yes, maybe there will come more efficient machines on the market in a few years, but on the other hand the circuit will be used more for other things. For the generic figures, we consider this. But for the load factor it is static, we will not say that the loading of a circuit in a factory will become more efficiently and that that is 20%. But we can simulate that in a sensitivity analysis, we can sweep the load factor and see what the impact is. So we take it in a certain way into account, but not everywhere and not for a base case where a circuit is put on the market. We think when a new circuit is put on the market, you will do these assumptions.
FN	I hear about refurbishments are the main driver for the collection of potential regulation. For refurbishments, normally also the loads are refurbished. So in this case, whether they are more efficient, than ok, they will consume less, than the cables should be also calculated for such loads. In principal, this should not create any mismatch.
PVT	Yes, I think so too. What we have found is that the most important efficiency gain is probably in the load.
CS	Can I just say a thing on the previous comment [of SB]; I see your point. But, we also know that the average number of appliances per household is increasing all the time. So yes, when replacing the refrigerator is maybe more efficient and it consumes less, but there is also a percentage of people that keeps the old refrigerator in the basement.
SB	Yes, for residential, but I think for the industry sector it is different.
CS	That is something difficult to model.
SB	Yes, I just wanted to know if it is taken into account or not.
PVT	Of course it exist, probably there are companies that are an example for everything. In the industry there are such diverse applications that it is possible that after a while a new process is invented.
SB	I am not even thinking of changing the processes, but only changing the motors to ones that are more efficient.
PVT	If we decrease the application, losses will always become lower, but they are interactive. So sometimes, we discuss interactive effects. For example if an application is reduced by half and becomes twice as efficient. You will have half the losses in your application, but in cable, it is by square. So, there are always interactive elements that make it more complex and our calculations are simplifications of the reality. In addition, we should see which elements we take into account and which elements not, and how we are considering it. Normally this will be done in the sensitivity analysis at the end of the study with arguments if it is meaningful to lower load factors and for what reasons. It is useful to keep this discussion in mind, as persons who draw up energy efficiency plans in companies are not only focused on losses in the cable but also on the loads. In conclusion, we should not replace the one with the other. [Note: In the end, having a good assumption on load factors is crucial; which is an element of Task 3.]

[Slide no. 30+31] Please provide us with more accurate data on the distribution of power cables, in order for us to update it with more realistic data.

abbr.	Comment/answer
FN	[Q on slide no. 32:] Is the stock calculated based on sales, divided by renovation projects? Or on the working plan [as mentioned in table 2-21 on the

	slide]?
DE	A: Yes, from the working plan, it should be from the calculated stock.
PVT	There are several ways to calculate that. You can have sales and stock data. We discriminate renovation sales sometimes from replacement sales for renovation of existing floor area and new sales for new built floor area. We should see how important it really is from which data we calculate it.

abbr.	Comment/answer
FN	I have read in the report that the prices are from web catalogues, I think that those prices do not reflect the reality of prices of installed cables and that they need to be representative of the reality.
PVT	We have made inquiries at installers and the prices are different per country. But yes, this can be improved. We have calculated the discount prices here based on our inquiries on what an installer can negotiate as discount.
FN	I think this is quiet sensitive. Taking prices from internet is not solid enough in my opinion.
PVT	We will see. In certain applications, yes, it is true, and in certain, it is not true. At the end, every 10% will count. We know the bottom prices of the copper below which the cables will not be sold, and we have the prices on internet. The reality is somewhere in between, so this can be improved. We also need to mention that the prices are for the 2010 scenarios. We should always correct the prices and the prices are very volatile. That is also a problem. For easy working, we have used internet prices including a 10% discount rate for the installer. This is said to us that that was the margin. It can be more which differs per country to country. But, this can be improved and is easy to retrofit afterwards. Of course, this is important for the improvement options at the end. We need a playing field between the bottom and maximum prices that we can use in the sensitivity analysis. This can be improved with input from the installers, but often this is a sensitive subject for an installer. For example, the catalogue prices in Belgium are much higher than what an installer pays.

[Slide no. 34] What needs to be conformed is whether a thicker cable is more difficult and costs more needs more time/costs for installation or whether that the length is more decisive. This can be improved and can be an inquiry to the installers.

Task 3 (PVT)

This task is on the use of the cable, like user context, loss parameters, End of Life. Important to mention is how we approach this as a product: the product in this study is the cable as a strict product scope. The circuit including the circuit breaker is the extended product scope. The electrical installation is seen as the system, and the buildings and the loads are the system environment. We use these terminologies in this context.
See PowerPoint presentation of the meeting and draft Task 3 report available on the project website: www.erp4cables.net

abbr.	Comment/answer
HM	[Q on slide no. 44:] Are the load form factors (Kf) of 1.11 and 1.06 possible for the industry sector?
PVT	A: For the form factor yes. A sign wave load is 1.4 for example and a continuous, flat load is 1. The average value is the same as the RMS value. From this table you can see that we have assumed quiet flat loads, as opposed to lighting circuits as lights are only switch on a few hours a day resulting into high factors. In dedicated circuits, we also assume that there not much used in

	the industry.
FB	Q: I am not sure if I am understanding the Kf.
PVT	A: It is a calculation of the load profile. And the average value of the load profile is not enough, there are more losses and that is reflected in the RMS value, root mean square value, that counts for the losses in the cable. The losses are the highest when the currents are the highest in the cable and that is reflected here. Of course, there are different ways to assess that, but the easiest method is with the equivalent times of peak load. In the study, an example is included of a calculation with two loads. You need two parameters, the average loads is not enough for loss. [See Task 3 report for more details on the calculation.]

abbr.	Comment/answer
SB	[Q on slide no. 48:] What you assume for the product lifetime for the industry and services sector sectors, how is it calculated?
DE	A: That is calculated from the renovation rate. In the industry and in the services sector, we have used 7%, as can be seen on slide no. 32, which is about 14 years.
SB	Is this in all the industry?
DE	It is in all the industry.
SB	I think this is impossible to have 14 years for product lifetime in the services and industry sectors and a product lifetime of 70 years for the total sector. I think there are some issues somewhere in the calculations.
HM	I am really interested to see a cable that is installed 169 years.
PVT	Yes, but we needs the average values of course.
HM	The figures that are presented now show it is stupid to calculate with averages…?
DE	It is based on the figures [on slide no. 32] that are based on a renovation study.
SB	Can you provide your calculation based on renovation rate? Renovation is one thing, but there is also demolition. Sometimes a building is never renovated, just demolished.
DE	If you have these figures [slide no. 32] and you have 7% for example. This is the replacement. Than you have 1 on top of 7%, which means 14 years.
SB	I think that 7% is incorrect.
DE	Yes, therefore we need better figures. These figures come from a study by Ecofys and were supplied by different sectors. So, if you have better figures, we will have better lifetime figures.
PVT	Yes, because from this, the sales and stock are calculated and that is important. If we have a big stock of cables and there is little energy going through the cables, the load factor will go down and the losses, the efficiency of the cables will increase. So everything is interrelated. Therefore, it is important to see the outcomes of Task 5, to see that everything is linked with each other and that we do crosschecks. [Note: The values that we are looking for are averages that produce correct total EU impact as discussed in Task 5.]
CS	So I think, what the group is trying to tell you, is that you need to do something about these data [on slide no. 48]. If the average is 170 years and if you assume a standard distribution, than this means that, some values are 200 or 300 years, which is impossible. So you need to revise the data or assumptions.
PVT	Yes, it is mainly for the residential.
SB	But you cannot say that the figures on the residential sector are the only ones that are not correct, if the figures are not correct for the residential you cannot expect that it is correct for the services and industry sectors. I know that the key is getting reliable data; but we are for sure that the value for residential is unreliable.
DE	Even if we take a renovation rate of 1% [instead of 0.59%], than we come to a

	product lifetime of 100 years.
CS	Maybe you need a more sophisticated approach, rather than taking a percentage and turning it upside down. You need a more sophisticated approach.
BG	Yes, not just assuming a renovation of 1 percent is 100 years...
PVT	What people say to us: 1% renovation rate is overly optimistic however that 1% is equivalent to 100 years product lifetime?
CS	Are you not confusing the renovation of a building with the renovation of an electrical installation? Because the two are not the same.
PVT	Yes, that is true. Recently in some countries there are checks of the electrical installation and the codes are changes, so the people have to reinstall the electrical installation before any other renovation work.
CS	I think you need a plausibility check, and what the group is telling you is that the figures [on slide no. 48] do not make sense. You need to try harder.
SB	I do not have a reference, but the renovation rate on a French label on the lifetime of a product considers a lifetime of 20 to 40 years.
MF	Yes, it is 40 years in France.
BG	The only good reference we have for renovation is Renovate Europe.
SB	However, renovation does not mean product life.
PVT	Yes, there is also a service life, because a building can also be empty for a while for example before it is rented.
CS	The installers, can they help in the discussion of what is the average lifetime of an electrical installation?
ES	Well, it is very depending on if it is residential and renovation rates in certain countries, on average we would say 50 to 60 years. To come back on what we said before, we should renovate more on the existing stock. In the industry, I do not know exactly, I would say it is renovated much quicker.
PVT	In Task 5 we will also see what is the impact of this. Because if the figures say that there is sold a lot and that the product life is long, it will mean that there is also a big installed stock. So that meaning that there is much copper installed in buildings. With the figures we have now, it more and less fits. Of course, if we increase the lifetime, we maybe have to say that the length of the circuit is much longer. Which can be the case, if the cables are not directly connected and on average longer. Another possibility is that the loading per cable is much lower. We think it is a mix, we think that the cables on average have a lower load, that there are more cables, and that the circuits are longer. It is difficult to have compliant data.
CS	We cannot move on like this, we need a strategy to improve those values. What are you planning to do?
PVT	The only thing we can do is having inquiries, mainly to installers and engineering companies.
ES	It is not easy to have the data. If you look at the installation companies, in the companies self, they do not do those statistics. The statistics on how much meters installed and so simple do not exist. Maybe the larger installation companies can have an idea of how much they have installed a year more or less, but the majority, 95% of companies are small companies.
PVT	And the precise sales data, and assumptions on the lifetime should lead to statistical data that we have on renovation rates. But low renovation rates, means a higher stock. The sales data should improve that with the manufacturers. The lifetime we can check with statistics from Euroconstruct or other sources on the renovation rate.
FN	Q: What is the relationship between sales and loading?
PVT	A: With the length of the cable, with the typical circuit… our proposal will be to have more base cases: highly loaded, medium loaded, and lowly loaded. The improvement potential will of course be in de highly loaded cable. The lowly

	loaded cables we will not deal with them. Probably, we will have the biggest effect by addressing the cables that are highly loaded in reality, and we need to find a way to select them and to improve them. Potentially, there are many cables installed that have a low loading, which is the reality and not something wrong.
CS	I think Franco wants to intervene.
FB	Yes, you were asking for a strategy on this specific issue. I think the strategy is that an electrical line will be changed if the process itself is changed. With this, you need to look at how much the process is changed. This strategy may give a direction; I do not have an exact solution. As the theoretic lifetime of a cable is very long, the process has a shorter lifetime. If I have to give a figure, in any case, I would say that the rough average is 15 to 30 years depending on the application.
PVT	We now use 15 years, what is in our feeling rather the minimum. But if we would use 30 years, we would have more cables in stock, resulting in a problem with the loading of the cables; or we should change the length? A possible new base case can be with many cables and low loads?

Task 4 (PVT)

Task 4 is also on analysing the product. Important elements of Task 4 for Task 5 are the Bill of Materials (BOM) and the volume. With the BOM the production impact is modelled and with the volume the transport impact.
What we want to improve is the installed cable in the circuit; we do not want to change the manufacturing of the cable. Maybe the only possible thing that needs improvement during the manufacturing is the insulation material and the recycling of it, only if the outcome says that there are many lowly loaded cables and that the insulation materials manufacturing plays a role; this could be. But in first instance, we say the issue is not to improve the resistance.
In the standard, the cross sectional area is a nominal CSA, but what we have heard is that in the reality, there is a guarantee on the maximum resistance. Nominal means it can be higher or lower but the standard guarantees the nominal, maximum resistance, which means that the quality of a cable is guaranteed by the standard. Therefore, we say that there is no improvement potential on the nominal cables, because the nominal cables have to follow this maximum resistance.
See PowerPoint presentation of the meeting and draft Task 4 report available on the project website: www.erp4cables.net

abbr.	Comment/answer
HM	Q: If you call it maximum resistance, it is the resistance maximum for 1 km or whatever length of cable at 20 degrees C?
PVT	A: Yes
HM	Q: It is not the maximum resistance at highest temperature.
PVT	A: yes
HM	You have to be very sure on the maximum resistance, because we are talking about loaded cables and the maximum value in the standard; it is different.
PVT	Indeed. We also have a problem with which resistance we are going to use for the real loaded cables, because it is lower than the maximum and it is higher if looking at the higher temperatures. In certain standards, you need to look at the maximum temperatures, and the maximum resistance on the maximum temperatures. So maybe there is an improvement potential, if some alloys have another temperature influence, but we are not aware of the improvement if the materials are changed to another materials that has a higher resistance at a

	higher temperature.
HM	There are tables inside the standards to calculate this.
PVT	Superconductivity or different insulation materials could be an option on product level, but the main improvement potential is the CSA or two cables in parallel, with refereeing to the standards.

abbr.	Comment/answer
JP	[Q on slide no. 52:] On what is based, that DC power will have an impact on the energy efficiency? What is the database on that? I think it is not true.
PVT	Q: Do you think this is not true?
JP	A: No, when comparing the data of the data we have it is true for 230 V AC more or less, but when increasing the voltage in AC you will get exactly the same results. So in my opinion you need to remove this "DC power distribution in commercial buildings", because it is not really true. At least you need to have any data on it.
PVT	But on the same safety level. Of course if you go to a lower voltage, you increase the current and then you increase the …
JP	Yes, because the main efficiency is to increase the voltage. But this independent of the fight of AC versus DC.
PVT	No, but on AC, as what is said to us or what you can find on the website of the Emerge Alliance, in the AC standards the installation and the safety level is determined by the peak. This means in 230 VACrms has 380 Vpeak that defines safety and 380 VDCrms has 380 VDCpeak. As a result, 230 VACrms can carry less power compared to 380 VDCrms for the same safety level and current loading of the cable; therefore, DC is more efficient in this case. Also in DC you do not have a poor power factor that could increase losses?.
JP	Yes, they claim, I agree on that they are some claims. If you write this, you need to prove this. Today, DC power distribution and AC power distribution are exactly the same if you use exactly the same voltage. When you compare, you cannot compare eggs with chickens. There are very different.
PVT	It is Best Not yet Available technology. We will see what we are going to do. I also think it is not really an option that we will say that Europe should switch to DC, so this is very hypothetical. It is only for the completeness and of course, we should add a line with the assumption that voltage level is increased.
JP	Yes, but you can do it in AC as well, it is not linked to DC. For me DC is not a new technology. It is really something that is already available. You can used it in some applications. Like photo voltaic, it is due to the source and then it is DC current that needs to be transferred into AC. This is quite a critical edge to at more efficiency. The way to become more efficient is really the voltage.
PVT	It is also important not to have a loophole at the end of the legislation. Imagine that we write legislation for new AC installations and that in a few years the market all wants to go to DC, resulting in a loophole?
JP	Yes, that is why I had the question on the scope; but I do not agree with that DC power is linked with more efficiency than AC power. It is not true.
PVT	But we make reference, so we refer to the responsible organisation, and maybe we will have success with that. It is important for us that we should also be viewing future developments in order to avoid loopholes.
JP	I do not have a problem with AC or DC, for me it is more or less the same. But with the fact that it is linked with energy efficiency.
PVT	Yes, we can take note of that, and of course, it is a fact that if the voltage is not increased there is no difference.
JP	Exactly.
PVT	So it is more a discussion on voltage levels that can be used in cables and in safety.
JP	Yes and not the type of current.

FB	I support this, because DC is linked with energy efficiency with reference to the conversion DC – AC. We are integrating sources with DC, we have DC appliances, and we are distributing to AC. So each DC – AC and AC – DC conversion is something that obviously leads to losses.
JP	In any case, there is also conversion in DC using the same voltage.
FB	Basically, the efficiency is linked to avoiding conversion losses, rather than distribution.
PVT	And that can be a bigger driver, so the driver is maybe more in the convertor and in the load. Maybe we should mention this in Task 2 as a trend. This might be the reason that people go to DC? If we are only writing AC legislation now and proposing AC legislation at the end, we might miss new products. This is more our point of view to mention DC, rather than to include or excluded it in our scope. We should be aware of this.
JP	But I do not agree with your opinion that people are going from AC to DC, there are no applications in DC only PV-panels.
PVT	There are batteries. Inverters in principal also start from DC bus internally for motor drives.
JP	Yes, but is not really linked with energy efficiency, but with the technology.
PVT	So, maybe we can put this also at the load level and say that there is also a driver at the loads for going to DC and it fits more with the loads efficiency?
JP	Just, do not speak about efficiency. It is not linked with the efficiency.
FB	If there is no DC equipment… at the end the end-use is the driver.

MS explains the Bill of Materials (BOM). We are not sure on everything that we have included in the BOM, so if the stakeholders have more information on the materials, please provide us with the information.

abbr.	Comment/answer
SB	Q: Are additives, plasticises and things like this not considered? They might not have impact on the energy efficiency, but as the Ecodesign Directive also mentions resource efficiency. It has to be noted that it is possible that some specific materials that are used in the cable manufacturing will have more impact on other Eco-indicators than copper, PE or PVC. You can request for data, but we cannot provide you this confidential information of manufactures. But it should be mentioned or taken into account in some way that some products or raw materials might have more impact than the three basic materials of cables.
SS	Just one point from my side: we would of course welcome such information to be included in the report. With respect to the confidentiality of the data, I understand that fully. But based on my experience from other preparatory studies typically the one on compressors, which also applies to the sales data in Task 2, the manufactures undertook from what I have understood quite an extensive exercise in which collected data were anonymised and collected by a third party, and by that means they were given to the study consortium. So, it is of course a sensitive and critical exercise, but I think in the interest of this preparatory study that it is welcome if it is in such sense possible for the parties involved to look into it and I would advise the study consortium to contact the person responsible for the compressors preparatory study. It took them quite a long time, so they have the knowhow in how that exercise was done and I think it benefitted the study quite a bit.
PVT	That is possible. In the data collection, we can sign a confidentiality agreement and we can aggregate the data as we already have indicated in our first inquiry. The data that manufacturers send us after the first inquiry we have made it anonymous. So we can do the same as for the BOM, if this is crucial.

DE explains the section on the distribution of product: the transport and packaging [slides no. 55+56]. The transport costs in the Ecoreport tool is a default value, which cannot be modified. This has a big, unrealistic influence if the unit used for the base case is very small.

abbr.	Comment/answer
MF	Q: Does the transport take into account whether a cable is heavier?
DE	A: It will be in the volume. The volume is the only parameter that is an input for the Ecoreport tool. There is no parameter for the weight of the packaged product.
PVT	The distance is also not a parameter for the transport. Only the volume is the only parameter. In the background report of the Ecoreport tool there will be more explanation on this, which we do not know by heart.
DE	It is also the tool that has to be used.
CS	The Ecoreport tool is a simplified life cycle assessment (LCA) tool to calculate the environmental footprint of a product. In the discussions we had during the development of this tool, we concluded that it is too complicated to model where all the raw materials are sourced from, the mines and the distance it travels for the production. To have a meaningful modelling, we would have had to throw millions of euros into to the modelling. So we agreed to the consultants that we give up trying to calculate this extended environmental footprint of products, so we simply do not make any assumptions where the raw materials are sourced from, whether they are from Chili, Asia, or Africa.
MF	Q: Is the transport the same, whether it arrives by truck, train, or boat?
HM	If there is no distance, it is invalid.
SB	Q: What are the assumptions used in the distribution phase of the cable? Is there a distribution or transportation module in the software?
DE	A: There is a transportation bases on volume.
SB	Q: Is it also used for the transportation of raw materials?
PVT	A: No, but this is in the BOM. The modelling of the production phase is purely based on the BOM of the product what Marcel had explained are the only input parameters of the Ecoreport tool.
SB	Q: The processing is not taken into account?
PVT	A: Yes, but it is not a full life cycle analysis as manufacturers do by themselves. This is very simplified.
SB	Q: Is it mandatory to use this tool?
CS	A: No, it is not.
SB	Ok, we can go into more detail on the calculation, but the raw materials are not always the most impacting input of the manufacturing. Depending on the environmental impact…
PVT	But I think that the MEErP parameters assume processing, meaning that the Ecoreport tool parameters are for 1 kg processed copper. So, there are already extrapolated or averaged for several processing steps.
SB	Processed copper can underestimate the environmental impact of cables and can lead to drawing false conclusions on potential impacts of cables. I want to point out that it could be very low values compared to the reality of life cycle impacts of the production phase.
PVT	Primarily in the working plan, products are identified that the use phase dominates, meaning that the precise modelling of other steps is of lower importance. That is also the rationale why it is simplified. Because, the initial idea of the commission was to go for energy efficiency with taken into account Ecodesign. Of course, if it turns out that the main impact comes from the production, than our method is too simple and everything sits in the small details. It needs to be clear that the MEErP is not suitable for that. We can

	mention this, but what you can do in parallel with your LCA tools is to check whether the outcomes are valid.
SB	We can check if your conclusions are in line with the conclusions we get based on a detailed LCA.
CS	That is very nice. To come back on your question whether it is mandatory or not, the methodology has no legal backing, so it is a means to an end to facilitate to work with consultants. So far, to the best of my knowledge, all the Ecodesign requirements are related to the use phase of products, and it would surprise me if this were the first product where we propose requirements that are related to the production. But, if you think that this tool is not sophisticated enough than you can double check with you own LCA tools.
SB	Of course, if you look at energy consumption, the indicator during the use phase may be probably the most important one. If you look at resource depletion, manufacturing plays the impacts for 90%. If you look at ozone depletion, than transportation is the most impacting one. So, in the end it depends on what you want to prevent in terms of environmental impacts.
CS	I think what we have in mind with this policy tool is the use phase of a product... some of you are looking at me horrified...
SL	What about the kind of environmental impact that we want to minimise? Just to be in consumption or also other kind of environmental impacts…
CS	I am not saying that is not important, but the Ecodesign Directive might not be the best tool to regulate those impacts.
SB	What I must say is that especially for cables, the resource depletion of copper is a big topic and contradicts if we at the end recommend that we need a higher cross section. Maybe we want to have a higher impact on resource efficiency instead of increasing the energy efficiency.
CS	I knew you would make this point eventually. The assumption is that the environmental footprint of the extra copper is negligible compared to the energy savings, but this needs to be documented.
SB	I can already tell you that it is not negligible.
CS	If it were not negligible, we would not regulate it. As I say, our working assumption is that this will be negligible and that has to be documented.
	Q: Is this already addressed somewhere in the preparatory study?
CS	A: Yes, we have had these discussions for electric motors and transformers. In general, more efficient means larger, because of the law of physics. In those two cases, it is already documented that the energy savings more than compensates the extra environmental impact of using more copper or aluminium in the products. We have had this discussion already before for other products.
SB	Q: How do you rank energy versus resource?
CS	A: There are several ways for doing it. You translate it to a common currency.
SS	As an environmental NGO, of course we want to see all the environmental aspects being tackled and therefore the study should address as much as possible. We recognise that the methodology might have some the limitations. The Directive is currently being revised and we see this is an opportunity moment to tackle other resource efficiency aspects. But I think for the purposes of this study, any other information you have would be very useful, we have to work within the system that we have at our disposal and try to see how we can make the best use of this.
CS	If there were zero burden shifting than there would not be environmental regulations.
SB	I know, I agree. Actually, because together with some mandate on standardisation to include resource efficiency into the Ecodesign Directive so… On what we can implement, what we do in one year, six months.
CS	Let me be clear on that mandate, we can already propose Ecodesign

	requirements on material physics for any products. The problem is with the non-attribute properties, that is why we have the issue to mandate, but this is in the directive since 2005.
PVT	Of course, this can be a recommendation or a finding, but this affects the production not necessarily the outcome. The improvement potential could be in the production process. The production of copper is quite standardised and maybe not a good example. It could be more in the type of insulation material to use based on the environmental impact of the insulation material. But this is a different area of the initial starting point of this study, where we have identified energy saving potential in our working plan and the method is suited for this. We assume that the copper used in cables is not very different from the copper used in transformers and motor. That is why it is already in the model as it already has been discussed. I would expect that it will be more in the insulation of the cables and the paper [of OVAM] on this is distributed.
ML	Yes, it is discussed in the paper, not in detail, but there are some recommendations.
FN	To finish the point on materials, I think that if none of the materials is identified as critical raw materials then it is a complete list. Or any other legislative framework, I do not think that we need to care about whether resources are going to be depleted or not.
SB	I have a report of JRC on the negotiation of resource efficiency measurements and copper is clearly identified as a key metal for the resource efficiency topic. So I think it is maybe not defined as critical in the EU definition in terms of economy and supply, but I think it needs to be considered as critical in terms of resource efficiency.

DE goes further explaining the section on improvement, design options and recommendations in Task 4 [slide no. 57].

abbr.	Comment/answer
JP	Q: Why is the topology scenario not the scope of this study?
DE	A: Then it has to be modelled. Then you have to know how the typologies of these installations are on average, where the load is located and where the distributions boards are.
PVT	It is in the scope of Task 6, the improvement options.
JP	So, it is not in the scope of Task 4 but in Task 6. So, the header of the last column is not correct in this case.
DE	This is a mandatory section of Task 4. This is the official heading.
PVT	Maybe we should reformat the heading in saying that is in Task 6 and that it is not a considered improvement option in this study, but we will keep this in mind for Task 6 as a policy?

- **Continuation after the lunch break of the presentation of draft Task reports 1-5, including: updates, questions & answers, discussion (PVT/MS/DE)**

Task 5 (DE)

Task 5 is about the environmental and economic impact assessment on the 5 different base cases with the use of the Ecoreport tool as provided by the MEErP methodlogy.
See PowerPoint presentation of the meeting and draft Task 5 report available on the project website: www.erp4cables.net

abbr.	Comment/answer

HM	[Q on slide no. 66:] If you have two or more cables, in parallel do you use the simplified method to add the current simply or do you know that there is an influence and that there is a reduction?
MS	A: Yes, we have considered the reduction.
SB	[Q on slide no. 68:] You said you cannot publish the responses of the survey of the installers?
MS	A: It is an average length.
SB	Q: So you cannot publish the responses and the resources of the installers. How much feedback did you get?
DE	A: Not that many, I think 10 responses.

DE explains the Ecoreport tool spreadsheets that are filled in for the base cases. The materials that can be selected are limited in the tool, for example for the insulation material high density polyethylene (HDPE) is selected.

abbr.	Comment/answer
HM	[Q on the Ecoreport tool:] Earlier you mentioned recycled materials for the insulation; there is one option for recycled materials.
PVT	A: Yes, we did not choose that one, because it is more for packaging materials. And HDPE is not the exact material that is used. So we use the materials that are as close as possible to the BOM.
SB	Q: Would it not be better to choose LDPE or LLDPE instead of HDPE?
MS	A: I thought it XLPE between medium and high density PE; or is it wrong?
SL	A: It is a low density, but not very low density.
SB	Rather use LDPE than HDPE. In addition, with regard to PVC, you should not use recycled PVC. It is difficult to use recycled PVC, because the manufacturer does not know what for substances are added to the PVC.
PVT	Yes, we can change this.
HM	May I propose something for the insulation material for electrical safety reasons; I have never heard that insulation materials are recycled materials.
PVT	But, the recycling process is very sophisticated, at the end if you buy PE it is from raw oil, so it is refined. You do not want to know what it originates from. It is the outcome of a factory and they recycle in the factory.
HM	It is a process to produce PE. It is different form recycling existing PVC to PVC again. It is really different. They recycle but it is not recycling in a way as it is used for building materials. It is not only just putting in a mill and extruding it.
SB	Recycled PVC is probably leaching PVC and you do not want to use that with copper. In cables, we use soft PVC that is compound based.
PVT	Ok, we will change this. What is interesting is if you have more data in order to compare the differences.
SB	Yes, we will make the remark.

abbr.	Comment/answer
SL	[Q on the results sheet of the Ecoreport tool, without changing the materials as discussed in the above:] We see that there are more environmental impacts than energy depletion. So in fact, the energy consumption is not the only impact that is taken into consideration when making the calculation.
PVT	A: Clearly, global warming potential is -17 emissions to air and you can see that the impact during the use phase is 139; nonetheless, during the production phase the impact is 29. So the production is not negligible. If the loading in the cable is zero, the impact during the use phase is also zero and the impact of the production will still be 29. Therefore, the loading of the cable plays an important role. Already we can see here that for the lighting circuit, base case 1, the production phase is not completely negligible with taken into account 50 years

	lifetime and a loading of 20% of the cable. On average, lights are used 2.000 hours of the 8.000 hours. If you would say that, the lights are used for fewer hours, than the production phase will be more dominant.
SL	But apart from the numbers, there is a political choice to not only considering the energy depletion impacts, but also other impacts. As said before, regarding the copper depletion, it is difficult to consider copper depletion as well as energy depletion. But here you have considered multiple impacts. When you have to make decisions, what are going to consider more, the energy depletion, the …?
PVT	Well it is not to us, we only produce these results. The Commission makes the decision. We are now collecting the evidence and these are the outcomes, but clearly, heavy metals are in this case more related to the production of copper and the use of coal to produce electricity is less important. For the incandescent lamp, it is different; the mercury in the lamp was negligible compared to the use of electricity.
SL	But the political conclusion is that the energy depletion is not considered only but also other impacts.
CS	The directive says that any environmental impacts associated to a product that is significant can be regulated. This is the first difficulty, because the significance is not defined objectively anywhere. It is subjected to political interpretation. So, this is the tool that is used to spot which impacts are significant. Then there is a long process to fulfil a number of criteria before the requirements are on the table. There has to be an improvement potential, affordability for consumers, and a competitiveness of the industry. So, we need to demonstrate that the requirements are cost effective, meaning that the industry can reasonable can accommodate it without making huge investments. Once this is all out of the way, then the Commission makes a regulatory proposal and then the member states decide. And in that process, a lot of things are abandoned. So to give you an idea, from that huge potential that the directive foresees, the reality is that there are 25 Ecodesign regulations, 25 products. Energy efficiency was regulated in all of them, water consumption in 2 cases, durability in 2 cases, and NOx and SOx in one case that is not even adopted yet. So you see from what is theoretically is possible compared to the reality, many things are abandoned right away. So at some point in time, we need to go from the technical considerations to the economic justification and ultimately to the political level which are the member states. In the end, you need to understand that if a proposed regulation is against the interest of a certain member state; they will manoeuvre to try to change it. In the end, we end up with minimum, common dominators where all member states and the industry can live with it.
SL	So, as a first step, we will consider all the impacts.
CS	Yes, but there is no system to arbitrate, there is no hierarchy of the environmental impacts.
SL	But you need to have a hierarchy.
CS	And who is the referee? This has been discussed many times. Whichever way around, we have decided there will be always someone that is not happy. The question on the hierarchy has been avoided for years.
SL	I understand the problem, but I mean that you have to consider it in any case, even if you do not consider the copper depletion, you will have 4 or 5 impacts. You have to have the hierarchy to discriminate the different impacts at the end.
CS	The study team does not have the mandate to prescribe the hierarchy of environmental impacts. It is problem that is very difficult to deal with. It is similar to the discussion in weighting the environmental impacts. The colleagues in the environment are trying this for years to combine all environmental impacts as a single indicator and to decide how to weigh the different impacts. That is why it does not exist.

SL	Ok, so there is no way to weigh the copper depletion.

abbr.	Comment/answer
SB	Q: In the calculation, is the use of a European electricity mix used?
PVT	A: Yes, this is in the MEErP.
SB	Q: Are you going to do a sensitivity analysis depending on the electricity mix?
PVT	A: No, that is fixed value to avoid a debate on how it should be mixed. We do not do a sensitivity analysis on the fixed parameters of the model.
SB	I was not considering a different mix of electricity types, but a country mix.
CS	We had the same discussion during the Ecodesign study for the transformers. Obviously, we are calculating the life cycle costs and the least life cycle costs; and the price of electricity is one factor in the formula. By definition, if the price of electricity in Germany doubles compared to the prices of France, the least life cycle costs will not be the same. So then, we are comparing apples with oranges. In the end, we need one piece of legislation and the fairest way to do it is a pondered EU average; as far as I know, that comes from Eurostat. You have to understand that we cannot have 28 pieces of legislation.
SB	Apart from product category, is it something that has been evaluated, how much does it affect the conclusions? Roughly to estimate if it has a high impact or not.
CS	The impact will be proportional to the spread in the prices of electricity across member states.
SB	Or the type of electricity?
CS	That discussion is loaded, because member states are very sensitive about their energy mixes. So there is not much that we can do.
PVT	But with the prices we do sensitivity analyses, but not on the mix and the impact of the mix. As the price is an input parameter of the study. The environmental impact of the electricity is based on a mix of Europe. The grid is interconnected so the assumption is that it is a single value for Europe.
CS	As a consolation, Norway has 99% hydroelectric energy and they are penalised by this energy factor conversion. Additionally, the Ecodesign regulations are applicable in Norway, but they do not have saying in this discussion because they are not a member state. So, they have the worst of both worlds: they are penalised by the energy mix and they do not have any saying in the discussions.

abbr.	Comment/answer
FN	[Q on slide no. 84:] The base case definitions…. You have a million installations?
PVT	A: That is also low; however this means that if increase stock there will be even more losses. We have also data on how many buildings there are in Europe. Apart from the end-use of energy, this is also a point where we can check on. Additionally, we have data on the amount of installations.
FN	Basically, you have annual sales that you have to allocate to the various categories. So how do you allocate them, do you consider the copper content? Is this close to reality, or do we just accept this as an abstraction?
PVT	Yes, of course this is an abstraction. In first instance, we simplify and we crosscheck to see where the anomalies are; but also in the input data.
MF	Q: Why are you only considering copper cables and not aluminium cables[1] too?
DE	A: Because we are only looking at indoor installations and it was mentioned to us that it was only copper.

[1] Post meeting remark from BG: BG would be happy to challenge the member companies of the European Aluminium Association AISBL regarding the use of aluminium inside buildings in Europe, if more detailed information would be provided from the installers who use aluminium power cables or stakeholders who put aluminium back into the discussion.

SB	That is not correct.
PVT	This is what we had from market sales data.
SB	It is not only copper.
ES	It is not much.
DE	In the installers' inquiry, it was also mentioned that is was copper.
ES	Aluminium is used too.
PVT	Of course, this will certainly not solve our problem; it will make it worse. This will mean that we have more stock and other cables.
SB	Q: If you have to include the aluminium cables, do you increase the lengths or the amount of cables to reduce the losses in your calculations?
PVT	A: Not the losses, because we have to compare the standards of aluminium and of copper cables. I do not know if this will lead to more or less losses?
SB	Q: The total amount of cables in buildings will then be higher?
PVT	Q: In weight or in volume?
SB	If you add aluminium…
PVT	A: Aluminium in weight for the same resistivity I guess it is lower.
SB	Q: You have taken the copper cables based on the stock. But if you have to add the aluminium?
PVT	A: Yes, we can have it on top, but we need to see what the stock and sales data were in the past. Of course, we need these data for the buildings and transporting the energy for the crosschecks we do. This means that we have more cables to transport the same amount of energy, and that the cables are lower loaded or unloaded probably. There are also other parameters that we can change, such as the length of the circuit and the number of circuits per area.

abbr.	Comment/answer
SL	[Q on slide no. 88:] The product price is this the total costs paid to buy the cables?
PVT	A: Yes
SL	Ok, because probably the term 'total cost' would be better.
PVT	Yes, but I think this is standard terminology in the Ecoreport.
DE	And here we talking about a circuit as the product, so the price is per base case unit.

abbr.	Comment/answer
SB	[Q in slide no. 90] The 904 TWh for services and 1030 TWh for industry, why do you only attribute them to distribution and not to all of the services or all of the industry?
DE	A: In the distribution circuits, it is 100%; so the 904 is going to all the distribution circuits. This is the top level. To the lighting there is only 10% going of the 900 TWh. Even if you add all the energy losses or transport in an average circuit it could be higher, than the energy consumption at European level. Because it going to two circuits, first through the distribution circuit followed by the lighting circuit. So, you have two times the losses. And if you add them up you have two times the energy transported.
FN	Q: But then in industry, there is 15% left that is going somewhere that is not in the picture.
PVT	A: Correct, the sockets.
FN	I mean it also reveals the losses.
DE	The losses indeed. Maybe we need to add more base cases, which is one of the solutions: one for sockets, one for lighting in the industry.
FN	Or at least, if it is close to the distribution that it goes somewhere.
DE	But, we cannot also say over here in this crosscheck that 100% is going to the dedicated circuits.
FN	Q: This is an abstraction.
DE	A: Yes, it is.
SB	Q: Sockets are included in the dedicated circuits?
DE	A: Actually, as a circuit it is not. The copper of the sockets is in lighting.
PVT	In this model, the lighting circuit models are included with the sockets as base case 1. This is a simplification, but this does not explain the big TWh.

abbr.	Comment/answer
FN	The two categories of inputs for the model, there are factual data, like annual sales and the measured energy transported; then we have assumptions, like the length and cross sections. You need to make a distinction between the factual inputs and assumptions. The factual inputs need to be respected, because they are measured. So if adjustments are needed, adjust the assumptions for the model not the facts.
PVT	The lifetime of the cable is also important. If you have the sales data and the lifetime of the existing stock…
FN	The lifetime is an assumption.
PVT	Yes, and we all agreed that 14 years is low; but we already have a stock that is too high for the energy consumption. This is the paradox that we have found. We thought the 14 years would be safe, otherwise the stock would be larger and the amount of TWh and the losses. Currently, the stock is a result of sales data multiplied with the lifetime; but this is assumed.
DH	Q: When we are talking about product lifetime, the existing stock is supposed to increase by 2 or 3% annual. If you calculate that for over 20 years' time that

	will suggest that you will have 50% more cables than that we already have in our buildings. That seems relatively too high. Maybe you should look into that. How did you calculate the stock increase?
DE	A: It is calculated with the 14% building renovation rate and the 1% new buildings.
DH	Something needs to be subtracted from that.
PVT	Yes, this model is already simple. It is static, thus the growth rates are not in there. But indeed, this something that we need to look at.

- **Data gaps identified to complete the study (DE) / Discussion on approach to fill data gaps and the potential launch of a new enquiry (All)**

Besides adding base cases, the data that we have used should also be validated. We have listed some data gaps [slide no. 95-100]. We hope that we can get more input on this; of course, we can aggregate the information and sign a confidentiality agreement.

abbr.	Comment/answer
CS	[Q to all the stakeholders:] Are you intending to send some data, or are you thinking about your lawyers already?
SL	A: The lawyers are always in our mind; in any case, we will try to find more data that is suitable for this.
SB	We will ask if it is possible to get data from the different manufactures. Even if we provide information, I do not know how much it will represent the sector, maybe 50 or 70, 80%.
SL	It will be difficult to raise information from the whole sector and that is usable for this kind of study.
CS	Well, if you cannot get it, no one can get it.

abbr.	Comment/answer
SL	Q: What do you mean with monitoring the energy?
PVT	A: Yes, monitoring the energy that is linked to the cable. In a factory, this would mean the loads and how much loads there are going on and off..
SL	This data can possible be asked from the installers, because they will also know the dimensions of the installers.
PVT	Yes, but there is also a standard for this and we can ask how much the standard is applied, as the architect can be different from the installers.
SL	In the case of the high voltage cables, are you looking at the cable makers who also install cables?
PVT	I think the study from the copper institute, was done by such a company.

abbr.	Comment/answer
SL	It would be useful to have a list with all the missing data.
PVT	Ok, we will circulate this.

abbr.	Comment/answer
FN	I think there are a number of companies that do energy audits, monitoring campaigns and service companies. I do not know If partnering with any of these companies could provide us with advice.
PVT	One of our activities was that, but the main problem with that they are always focussed on the most energy consuming circuits.

- Any other business

/

- **Planning and Closure (all)**

abbr.	Comment/answer
CS	Q: Paul, can we discuss the next steps in the study?
PVT	A: The most important thing on the short term is to see which data that we have and make a short list of the data that we are still looking for that we can circulate to all the participants of this meeting; in order to define the data gaps and possible solutions. This needs to be done before the end of June. The planning is that we have new input data for new calculations, optimisations, and the new scenario's at least at the beginning of August, in order to produce the first draft outcomes and to hold the third stakeholder meeting by early November.
CS	This means that you will have circulated the drafts for weeks in advance. The beginning of October?
PVT	Yes, the beginning of October.

Data of next stakeholder meeting: Thursday 13 November 2014.

abbr.	Comment/answer
SL	Q: Is it possible to have an idea of the future steps after February 2015?
CS	A: How this works is, that the burden of proof is on the Commission. So, we need to make the case that regulation or Ecodesign labelling makes sense. So far, I am not convinced myself. Maybe this will be changed by February. So yes, there is a potential for saving energy, but maybe Ecodesign regulation is for this not the best way of doing it.
SL	Q: Will there also be public consultation in February?
CS	A: Only if a regulatory proposal is on the table, then we will do the next step, which is consulting the member states, industry, environmental NGO's and consumers. But, if we are not convinced ourselves, there is no point in continuing the consultation forum. It could be that there is still something to do on the standard site and that it will be discussed further, to discuss whether we need to mandate or not.
SL	Q: That will be some months more on top of February?
CS	A: At the moment there is no regulation on the table, so there is less pressure. Standards are ongoing and we can take advantage of that.
SS	I understand that all the options are still open. For the record, as an environmental NGO, we perceive very clear distinction between the legislative procedures and normative procedures and the way they are formulated. Specifically, I am referring to the fact if there is a legislative proposal that is taken to consultation forum in which member states and other stakeholders have the opportunity to react; where in as in the standardisation processes, environmental NGO's and consumers might not have access to consult. So, if there would be requirements set on energy efficiency, we would prefer if they were set in a more transparent process such as the one under the Ecodesign Directive. This is obviously informative.
CS	Maybe I can explain how the framework works. One of the reasons why Ecodesign Directive is working reasonable well mainly for households products is that there are targets on European level for energy efficiency. And the Ecodesign Directive makes a small contribution towards these targets. All this is modelled, so you can see how much of the overall target the Ecodesign of boilers for example represents. With regulation, you have a certain reassurances that those savings will be materialised, because you will have shift in the market. When relaying on a standard, the standard my help products to become more efficient but you do not have reassurance, as it will be left to the market.

	So that is these distinction between having regulation and a standard, or having only a standard. Because of the binding target of 205, there is a pressure on Ecodesign to deliver parts of those savings.
SL	It will be necessary to avoid inconsistencies between standards and regulation; otherwise it will be impossible to act.
HM	That is not the problem. The message is that standardisation is voluntary and we are talking about targets to be finalised by 2020, and we are talking about products with a lifetime of, 30, 40, 50 years.
JP	It needs to be considered that pushing everything in one regulation is not always the best solution. Making regulations is sometimes not as efficient as to leaving it to the market to decide to go into the right direction.
HM	To clarify access to standardisation point, I will report this to CEN/CENELEC.
SS	No, we have access.
HM	Ok, than you have to come to the meetings.
SS	Of course, I accept your invitation; but we have limited resources. I wanted to point out that principal differences we have with accessing and explaining standardisation if voluntary in any case…
JP	Not for any case, for example in France, if European standards or CENELEC TC20 are published in France then it is mandatory in France by regulation, by law. So, it is not exactly always the same.
CS	The point is that the burden to reduce CO_2 emissions and enhance energy efficiency has to be spread across economic and social actors, and if you leave it to the market than it is not clear who is in charge. There is too much at stake to leave everything to the market. That is why you need targets and need to intervene in markets. When we have to many doubts with delivering a regulation, you should refrain from delivering.

ANNEX D MINUTES 3RD STAKEHOLDER MEETING ON 13TH NOVEMBER 2014

Date :	13/11/2014	Ref.	Final version
From :	daemst	Annex(es):	- presentation 3rd stakeholder meeting - (draft) reports Task 1 – Task 7 (see documents on www.erp4cables.net)
To :	Cesar Santos; ENTR Lot 8 Stakeholders		
Copy (CC) :	Paul Van Tichelen, Dominic Ectors, Marcel Stevens, Arnoud Lust		

Minutes of 3rd stakeholder meeting for the preparatory study Lot 8 on Ecodesign for Power
BREY Building, Brussels, November 13, 2014

Present	Name	abbr.
European Commission		
DG Enterprise	Cesar Santos	CS
Project Team		
VITO	Paul Van Tichelen	PVT
VITO	Dominic Ectors	DE
VITO	Wai Chung Lam	WL
Stakeholders		
Europacable	Annette Schermer	AS
University of Bergamo	Angelo Baggini	AB
CENELEC TC64 WG29	Jacques Peronnet	JP
EDF	Maud Franchet	MF
CENELEC TC20	Helmut Myland	HM
Deutsche Energie-Agentur GmbH	Rafael Noster	RN
BAM (German Federal Institute for Materials Research and Testing)	Daniel Hinchliffe	DH
AIE (European association of electrical contractors)	Evelyne Schellekens	ES
ECOS / Sea Green Tree	Catriona McAlister	CM
ECOS	Chloé Fayole	CF
Belgian administration Environmental product policy	Bram Soenen	BS
OVAM (Public Waste Agency of Flanders)	Marc Leemans	ML
Aurubis Belgium	Mukund Bhagwat	MB
ECI (European Copper Institute)	Fernando Nuno	FN

ECI (European Copper Institute)	Laia Perez Simbor	LPS

Objective of the meeting
Stakeholder consultation in the framework of a study with regard to Ecodesign of Power Cables (Lot 8) accomplished under the authority of DG Enterprise of the European Commission (EC), under specific contract No 185/PP/ENT/IMA/12/1110333-Lot 8, within the multiple framework service contract No FC ENTR/M29/PP/FC Lot 2, preparatory studies and related technical assistance on specific product groups.

The main objective was to discuss the technical aspects related to the study (Task 1-7 reports).

Agenda
- Welcome
- Short presentation of participants
- Tasks 1-3
- Tasks 4-6
- Break &lunch
- Draft Task 7
- Any other business
- Planning stakeholder feedback and finalisation

Minutes

Welcome (PVT)
This is the last meeting to meet each other before the final delivery of the study to the commission.

Short presentation of participants (all)
See page 1.

Tasks 1-3 in a nutshell, incl. latest enquiry input (PVT)

Task 1 (PVT)
See powerpoint presentation.

abbr.	Comment/answer
JP	A comment on the IEC 60364-8-1 [mentioned on slide 12], the voting on this standard is positively and will be published within this month [November]. On the standard at European level, there are already positive votes. Tomorrow [14 November 2014] will be the final voting and if that is positive too, then it will be published within two months. So both standards will be published soon.
PVT	OK, if you can provide us the latest news these coming weeks we can add it to our study.
JP	Yes, I can provide the latest news.
MB	The last line 'Qualitative but not quantitative?' on slide 12, what is meant with it?
PVT	With quantitative is meant 'minimal benchmarks' or in terms of legislation 'the minimum quality that is wanted'. In the report the used phrasing must be correct. What we see is that policymakers want minimal benchmarks, which is also in the case of energy efficiency: the state of art should be this. I think all these ideas are in this standard and are a very broad area. But it doesn’t indicate what the minimum are for implementation. For example for this case, this could be that only heating, ventilation and air-conditioning connected are taken and the cable losses in lighting circuits also. Mainly typical loadings

	profiles and sample calculations are missing.
JP	One of our problems was to convince especially the installer, as the focus was safety at first and now we are trying to shift from safety towards energy efficiency. The first step was very difficult to push every concept of energy efficiency, so we have made some consensus. In the future for sure, we will push more towards energy efficiency in the standard but step by step. Acceptance of the majority is needed, that is why it sometimes can be seen as slow.
PVT	Yes, it is important that the standard is voted as it as a first step it could be updated in a later revision.
JP	Exactly.

Task 2 (PVT)
See powerpoint presentation.

abbr.	Comment/answer
CM	A question related to the sensitivity analysis and copper. The copper price, doesn't it have a substantial impact on the feasibility of certain solutions?
PVT	There is some documentation on the copper price.
MB	Can I comment on this? We follow the copper price regularly and the price depends on how much China is storing it in warehouses and uses it to finance other growth opportunities. So it has less to do with the demand and supply of copper, but more with its storable value and financeability value. This means that it can be stored at a warehouse and that that warehouse can be secured much better and at a cheaper cost than gold or silver. This is not something what only I am saying. There are many studies, which say that the copper is dependent on many factors and that the demand and supply factor is less than 1%.
CM	But isn't something, when talking about large volumes and copper, is it something that we need to consider that the price goes up and how it does impact the feasibility of the solutions?
MB	But then, again there, you will always have to consider the rest value. That copper at the end of its service period still has the same value, and most of the time it has a higher value than it was purchased. Copper can be recycled, let's say almost 99 to 100%; if you can collect it and bring it back etc. etc. So I think we should consider copper price form the let's say first use principal, but when considering on the life cycle, it is only the processing fee. And the processing fee, to give you an idea, is about 190 dollars and the copper price 6.700 dollars. So if it is possible to bring back copper to the smelter, which takes time and money and I won't say that that goes easily, but that process is already going for the past 20 to 30 years as compared to steel or some other materials. The recycling is processes on the day. And regarding the scarcity of the material, it depends only on the price. If you increase the price, what has happened one year ago, to 8.000 dollars, there were so much investment done in mining that now there is so much supply that the price has gone down. So this is the same with oil, with steel or another material, I think that we can conclude that this is the economic cycle. And this is why other studies by the European Commission including DG Enterprise and DG Energy are saying that copper is not a scarce material; but this doesn't mean that we should throw it away, but use it consciously.
PVT	And what is also of influence is that copper relies on international factors
MB	It is internationally priced, so it is the same price all over the world. The concentrates are coming from 30% from Chili and another 30% from a group of countries with Mexico, Peru, Indonesia and 2 or 3 others. The European copper availability is less than 2 or 3% in total: in some extant it is from Bulgaria,

	Serbia, etc. Russia is an important producer of copper. If the availability of copper will be become important than at the same time our export will be an influence factor, because copper is used in almost everything.
BS	In Belgium, there is a big smelter as well. I've seen copper being recycled and if you only need a few percent extra copper per year, taking into account recycling, than the prices will shoot out an extra percent…
CM	The price of copper fluctuates a lot, so it would have a major influence…
BS	If you look at the growth rate of copper of 1 extra percent per year, the rest of the year will always…
MB	The fluctuation of copper may affect the investment…
CM	Yes, exactly, if a building company is looking to invest in solutions in the cross sectional area that he normally could choose, but he only can choose solutions that double the cross sectional area and the prices are high, that could cause serious issues. It just seems to be something interesting to be look at in the sensitivity analysis.
DE	Yes, we have it in Task 6.
PVT	Yes, in our sensitivity analysis in principle scrap value is equivalent to a lower cable price.
MB	One more comment: 30% of the copper consumed in Europe comes from recycled sources. Also within in our company, all the copper we produce, depending on the site, between 10 to 100% is from recycled sources.
CM	What is the recovery rate of copper in buildings, for example in cases when circuits are replaced or a building is demolished, are all circuitry being removed?
LPS	The recycling rate of building is higher than 95%. I can assure you that all the copper in a building is taken away.
DE	In the Ecoreport tool, the value used is 95%.
PVT	We used pessimistic figures on recycling, despite the comments we have received. Because we think that at the end some of the copper in building scrap will end on landfills. We can discuss whether it should be 95 or 99%, but this won't make the difference, we need to be realistic. At the moment cables are even stolen before they are installed, which isn't also in the model of course.
LPS	When you buy a house or a building, you make an investment and you invest in de copper cable that is there. The details in price between the scrap coming from cables and pure copper fluctuates a lot, the market is really similar. When making an investment in your house as a consumer, you're investing in cables but also in a recovery that will come in the future, if this is not for yourself than at least for society. So we need to have a broader view: what is the initial investment and what is the recovery for society.

abbr.	Comment/answer
DH	In terms of your base cases: how much of the cable markets does this study cover regarding installed and purchased? Is it something like 20% of all installed cables? Do you have a number? If copper cables in Europe are e.g. 50% of the copper usage in Europe then if the policy measures would double the copper usage for 20% of cables that would increase the copper usage of Europe by 10%, which would be significant. So it would be interesting to see as well how much of the copper market we are expecting to affect.
PVT	The impact on the share can be calculated.
DE	In Task 2, there is a section on how much copper is sold in Europe and how much the estimate is for cables.
FN	According to the comparative study, the base cases of 2010, the BAU scenario points at 374 kton conductor material. This has to be compared to 4.5 million tons as product market in Europe and represents 8%.
MB	I don't know from data if it is 50%. Based on my market knowledge, in total electrical applications, everything included, will still be less than 25%. Of which

	copper is just a small part.
DH	The European Copper Institute said that it is around 8% for cables.
PVT	We can more or less deduct it from our figures and it is rather like 10%, so this isn't the majority of copper installed for this application. If we double it, this won't have that big of an impact.
FN	When we are talking about installed in buildings, the power cable market is much bigger…
PVT	What we've seen in the annual reports of the cable manufacturers is that the cables we are talking about are estimated as one third of the turnover and the biggest is 5 to 7 billion worldwide and the European share is part of that. In Task 2 we have also included references and our analysis of the most important annual reports. When we compare our figures, we think that they more or less fit. So we cannot say that that amount of copper cables, 5-10%, is an insignificant part of the turnover of those companies.
MB	If the average consumption per capita in Germany becomes the European average, it will double. The amount of copper used in Germany, is I think 15 kg per person. The European average is less than half, about 5-7 kg. So, the copper usage in Germany, if going van 15 to 30 kg, of course will have a bigger impact than let's say for Bulgaria where than it will goes from 3 to 6 kg. So we need to be careful with the general assumption that it will double for whole of Europe.
PVT	In Task 2, there is an overview. Table 2-7 gives more data on this, which confirms this more or less.
DE	Yes, when looking there, you can see that cables for low voltage energy, it is about 1,000 ktons and the total is about 3,000 ktons, but this includes Russia and east of Europe and more than just in buildings.
PVT	So the figures are there and we can come back on the impact in Task 7 with reference to Task 2.

Task 3 (PVT)
See power point presentation.

abbr.	Comment/answer
MB	A question on slide 24: these end-of-life parameters are for the whole of Europe?
PVT	Yes
MB	Because in some of the east and south European countries, the recycling rate in general is much lower compared to Flanders, but I think it might be realistic.
PVT	But even then, it must be realistic in our model. We have a lifetime of 25 years, so it will only have an impact in our model after 25 years. These figures are applied only in our study 25 years ahead. We cannot know what will really happen at that moment. So, we might be pessimistic. Normally, in all studies of this kind the actual figures are applied, but of course the habits of people might change. So when implementing a policy measure regarding the end-of-life of cables installed today, the impact will only be over 25 years. So there is plenty of time to work on the recycling of cables. We can make recommendations on the recycling of cables, if there are ideas on that, but this is relatively outside the scope of this study focusing in new products brought on the market. In our study we have made reference to the study by the OVAM, also on recycling of insulation materials of PVC-cables. But on other cables, like flame-retardant cables, there is no data on the recycling. We can recommend studying more on the recycling of other cable insulation materials.

Tasks 4-6, based on updated input incl. improvement options and sensitivity analysis (PVT/ DE)

Task 4 (DE)
See power point presentation.

abbr.	Comment/answer
JP	One comment [on slide 30]: this is not due to the fact that you use DC that it will improve, because if you do the same with AC, it will be the same. What happens is that you will increase the voltage, and then you can use AC or DC to get the same results. SO in my opinion the comparison you take is not fare.
PVT	Yes, but the point is on the insulation material. People regarding insulation material say that the insulation is fixed by the peak voltage and that it is always higher in AC than in DC due to the alternative current.
JP	Yes, but you are only taking one part of the problem, which is insulation, and then you take the conclusion of that one part and apply it to the whole, saying that the whole building will be far more efficient. In my opinion, mentioning it in this way isn't fair. Today we do not see a big advantage of DC on AC; this is only due to way the current is used. For example, it is comparable with using gasoline or diesel in a car, it doesn't improve the efficiency.
PVT	But we say, on system level, the impact is bigger, because you need switches and with DC it is more complex to interrupt the current due to the arcing problem. So in our text we also say that is more complex to switch from AC to DC and that it isn’t easily. It's an ongoing research, which is done in the US, where they are doing it for lighting.
JP	Yes, but the problem for the US is that they use 110 AC, so in comparison the impact is much bigger than in Europe with 230 volt.
MB	Is this so widely spread that you need to mention this?
PVT	No, but it is only to mention something. This is the only BNAT that we know of that we can mention.
DE	But is commercial there.
JP	Yes, we know that there is some experience with this. But once again, if you increase, do the same with 400 volt AC you will have exactly the same results. Therefore, I do not agree with this.
MB	I think your statement can be added in addition.
PVT	It is mentioned
JP	For me it is not DC, it is the voltage and if you increase the voltage, than I agree, but do not mention DC or AC.
PVT	No, but we think that with the same amount of insulation around the cable, you can in DC use it for a same safety level…
JP	No, sorry, it is not DC; it is really linked with the voltage, so increase the voltage…
PVT	Yes, it is with the voltage, but the voltage in AC for insulation is peak voltage and not the RMS voltage.
JP	Yes, but we have a good example when we move to project normally; we would use 400 volts AC when it repays. When we move to projects, to design, to improve the efficiency we would move to 690 volt. And then you improve the efficiency, but it is really the project, and most of the times the technology isn't available and we have exactly the same problem. Except when you replace the copper by silver or gold, but economically it doesn't make any sense. And this is exactly the same, so we know that there are other technologies. But today the costs of those technologies aren't good and actually if you mention increase of voltage, I would agree, but not changing the type of the current.
CM	I've thought with DC that there are advantages with power factors as well.
JP	Yes, but it is totally different, because you also need a lot of convertors and

	when speaking of using DC voltage, like in your computer, there are probably 12 different voltages and needs a convertor for each. Once again, it is really something complex that is not liked with AC and DC, when you increase the voltage you decrease the current, which is the flow in the cable then you improve the efficiency.
PVT	We going to keep mentioning this in the report as a reference, it is a reality; companies are bringing related products on the market. For example, Philips and ABB…
JP	For sure, there is some technology; once again I don't say that it isn't one. But this can either be done in AC or DC. On one of your first slides, you mention new technology, but this not new technology and not linked with issue of AC – DC, but it is linked with the voltage, a higher voltage. It's the same with lighting, maybe in the past 12 volts was used and moved to 25 volts, by increasing the efficiency of the system and not linked with the fact…
PVT	No, but it is linked to the voltage and as far as I know, the maximum voltage in DC is always higher than in AC in RMS. Maybe you disagree with this, but this is what I've found in the catalogue. What we are saying here is that the RMS voltage for a same cable is always lower as the DC voltage.
JP	Yes, but in this case, we also need to speak about the problem of insulation, when you are in DC…
PVT	Yes, that is what I've been trying to say.
JP	Yes, but the magnetic field is always in the same direction, so the insulation will be destroyed more easily resulting in a higher frequency of cable replacements, far more often than AC. I don't say this isn't the truth, but it is just a part of the truth.
PVT	I think it is broader and very difficult problem…
JP	Yes, and this is where I'm not comfortable…
PVT	But this isn't important here….
JP	Just say that it is an example, but don't say it is at the top.
PVT	This is just the PowerPoint, please read the text in the report; we have reformulated.
JP	Yes, because once again, if you move to DC, there will be a problem regarding safety. When cutting an installed cable, there will be a fire.
PVT	Yes, the fire risk is higher.
MB	The last sentence on the slide [# 30] also says "Therefore it will not be considered as a viable BAT improvement option."
CS	Please document the stakeholders' views and move on.
PVT	Yes, and if you have articles, please send it to us and we can refer to it. Critical views are certainly welcome, as the articles of the EMerge Alliance are mainly commercial documentation and overly optimistic. Important aspects that we can use more information on are on arcing, the difficulty to interrupt currents in DC, and safety and fire hazards.

abbr.	Comment/answer
HM	It is mentioned several times that the insulation cycles should be different between AC and DC. In the tables of the cable standards, you will see that all the small sizes with the same insulation cycles, is not because of safety, but is because of mechanical reasons to produce such a cable. So all the low voltage area has a cycle due to the ability to produce this layer with regards to safety.
PVT	We can mention this, while it is less relevant. More criticism on what we have found in the literature is welcome.
HM	There is a lot of discussion in AC on usage of DC.
PVT	Yes, we have also seen it in the literature. Therefore, I think we need to keep it, as we need to avoid loopholes in legislation, if legislation is only made for AC. This is the main reason to keep this here.

Slides 31 and onwards on Task 4 only present what is changed compared to last meeting. For the full text please consult the report (see documents on www.erp4cables.net).

abbr.	Comment/answer
CM	A question on the design options, it was mentioned elsewhere that changing the design of circuits it should reduce the losses as well, but this is not considered as one of the options.
DE	It is not considered as an option, because it is on system level and it is the design of an electrical installation. But is in the sensitivity analysis: what will be happen if you have longer cables, so it is considered there.
CM	Another thing as far as the options go; it seems that the technology options focus on the energy side of things. Are materials aspects such as the insulation not considered? Is there an intention to add that?
DE	We have considered materials in the next tasks. You will see that we have looked at it with the impact parameters of different solutions. But we did not look at an improvement option when you have a different kind of insulation. We also hadn't seen more information on this in the study of OVAM. The main thing is that we don't have any data.
PVT	The first thing is to produce the outcome and then we can see what the relative impact is of insulation material. But in the study of OVAM also didn't point out any new manufacturing techniques or materials, only some rough mentions.
BS	Yesterday, I've seen some data on television recycling and what we saw is that the recycling of plastics is very complex due to the many different plastics and different flame retardants. I don't know if it would be possible to have a simplification in the materials used, because everyone uses a different flame retardant in PVC that is incompatible.
AS	I can give a short reaction on this, there isn't much but there is some experience with the recycling of plastics. Technologically a lot is possible, but in many cases it is an economic issue due to the collection of small volumes of plastics. Also in general, secondary material contain a lot of contaminating materials in it from the splitting and then it is costly to make the plastics suitable for recycling. So in many cases it is an economic issue as well as the absence of a good market for moulding products, as mixed plastics in general can only be used for moulding products.
CM	So, is it something that can be assessed as an option?
AS	Yes, we should look into it further, when relevant.
HM	When talking about recycling, I think it important to mention that due to safety reasons it is not possible to use recycled materials as an insulation materials.
AS	Yes, it is always downgrading.
HM	So, when a cable is separated, you will have copper parts and some kinds of plastics. You have to separate them to get the copper, and the remaining plastics are being used for producing bumpers or something else. Is this the kind of recycling you are talking about?
ML	We can get contact with the contractor of our study to get more information on the end-of-life.
PVT	Yes, we have read the study but it wasn't detailed enough, it rather confirmed what we already had on that standard materials can be recycled. But of course if we can get more details on the composition from the manufacturers, that would be better. Also it is not documented which fraction of PVC is recycled. Another issue is that the currently used cables are apparently recycled according to your documentation and it is technically possible, but there are also halogen-free cables on which we have no documentation of on how they are recycled. In our study, this is only recommended as something for further research.

AS	I can confirm that there have been internal studies on the product waste, where the plastics are still in the process but contain already some of the materials mentioned in the table. Then they can be recycled and used in the process again. Whereas at the end-of-life, the plastics have contamination in it, as where HM was talking about, and that's the difficulty. So it isn't the material itself, it is the EOL material.
MB	The word recycling should be used more precisely: is it upcycling, used in the same purpose, or down cycling…
PVT	We followed the MEErP methodology and in the method there is no closed cycle philosophy in the sense that the recycled products are used in the product itself and that there is a bonus for this way of calculation. Of course, this is a general point of discussion and copper could be used in plumbing or in cables/
MB	For example, recycling of this mobile phone, if 98% recycling of the copper can be achieved this would be very good, because for the remaining 2% the costs will be very high.
ML	I think that in our study it was concluded that is possible to reuse the plastics into new production of plastics for cables.
PVT	Yes, but it wasn't concrete in which kind of plastics we should use as filler material. It is a general idea.
MB	Well the point is, that we can make recommendation that it should be promoted etc.
PVT	If they are available, such precise recommendations could be included in the study…
ML	The recycling cannot intervene in the production phase…
PVT	Yes, but it is possible to make products that are more easy to recycle, by using another compound for insulation material.
ML	I understand this is an important topic, but as I saw the core was about cables installed inside buildings and the energy losses.
PVT	Yes, and there are other directives on this such as the EPBD
CF	Well, the EPBD is not good here. This study should be more than only based on energy.
PVT	This is something that can be addressed.
MB	It can be taken into the recommendation.
PVT	What you can find in our findings is that in certain applications it is indicated that it is important to look at it.

Task 5 (DE)
The main difference with the previous version of this task is that we now have 9 base cases instead of 5.

abbr.	Comment/answer
SB	Question on slide 38: only copper and aluminium is used as conductor materials, but is no there also a type of conductor of copper plated aluminium?
AS	No
PVT	You can find it in loudspeaker cables for some commercial applications, but not in buildings.

abbr.	Comment/answer
MB	Shouldn't you consider some rest value and how? The prices are always higher than at the time of installation, it never has gone down. It can be significant when you are looking over a 10 or 30 year period. Also as the Commission always distinguish processing costs and material costs in their discussions.
DE	I'm trying to remember if it is in the Ecoreport tool.
PVT	Probably, there is a scrap cost. We can do a check and if it isn't we can add it

	ourselves.
DH	Isn't that a bit irrelevant? As cables are basically being replaced by thicker cables instead of thick cables being replaced by thinner cables.
MB	In this case what I mean to say is that there is no money allocated for rest value. It had some value and usually is increased. So if conservative estimates are taken for the existing value, than it is more realistic to also take a rest value. Or installation based value.
PVT	If a less efficient cable is replaced than there is a benefit, but this would make it even more complex. Keeping a value at the EOL is probably the simplest thing.
DE	I was also thinking about who is doing the investments, is it the building owner? And who gets the rest value of the copper?

abbr.	Comment/answer
JP	What do you call connector cost?
DE	Using a connector in a circuit, having a connector.
JP	Without protection, or an outlet? Because there are things that need to be kept in mind when the section is increased, like doubling the protection. And the size of the circuit is limited if a second outlet is added. Just keep in mind that there are limitations.
DE	We have qualified this somewhere in the text, by speaking about extra circuits or outlet.
JP	Okay, so you are aware of this issue.
ES	So, does this imply that all what is installed behind the cable will be more expensive, because of the use of a different section? Knowing that the residential sector is 75% of the building stock, did you do the exercise on the return of investment of an electrical installation that an installer has to sell including the changing of the cable and the benefit of the energy savings for the owner?
PVT	We do not focus on the residential sector, to be clear; we mainly focus on the dedicated circuits that are well thought and well installed. There it is mainly having enough space and the possible issue as just explained on the protection device that needs to be changed when circuits are in certain levels and ranges. In principal, a proportional installation cost will increase in our model. When going to a bigger section the installation cost will change proportional.
DE	Due to the outcomes of the first screening, the residential sector was excluded in Task 1.
PVT	In the residential sector, or in sockets, or in lighting, it might be very difficult to do this. In other circuits where we are focussing on, it is quite common to select certain CSA, and change the whole range with certain prices.
ES	Well, the question remains the same, even if you don't consider the residential: the return of investment between the investor, occupier and the installer; how can an installer sell this, what is the benefit?
PVT	This will be show in Task 6.
DE	What we have seen in the responses of the installers on the enquiry is that when selling an installation, only the investment is an important aspect for the customer without looking at the long term or the ROI.
PVT	None of the installers indicated that he convinced a client to choose a bigger CSA. So we don't have evidence or examples that a client asked for a bigger CSA than required by the safety standards.
JP	Want to comment that cables are already oversized at the moment. I don’t know what you concluded in Task 6, but the conclusion can be that there is no need to increase the CSA further as it is already oversized. In the case of the industry sector this is different where the cable is optimized.
PVT	Statistically this is confirmed by the cross checks, that most of the cables as you say are already oversized. For a big part of the cables your statement is true. In

	our findings we saw that when the load parameter is taken as a median for the calculations, we end up with a number for the energy used that is much higher that the energy produced in the EU.
MB	I think this is normal, probably the safety standards refer to the peak value, resulting that the average value is much less.
JP	It's just an optimization between safety, energy efficiency, manufacturing and so on, so it is just a combination of all these factors than just only one.
MB	I'm also participating in the European Commission group on energy efficiency financial institutions, there is said that there is 50% potential in buildings and 50% in the industry. And there the issue is that what we design today will determine the lock-in effect for the energy efficiency. So I will support you to consider the energy price, although it is not realistic at the moment as in some places it is said that the price is too low and in other too high. At what time will the installer be considering the energy price in its operation?
JP	This is what we've included also in our standard, to check especially for commercial buildings that the way a building is used will evolve in time and the building in time can remain energy efficient.

abbr.	Comment/answer
DH	Suggestions for a cross check: the amount of fixed copper sold in the EU has been constant since 1980. Try to figure out if the stock has been growing with the same rate. This is a linear growth not an exponential.
MB	The following nuance has to be made on that: the copper usage in western EU before and after 1989 was around 1.9 to 2.0% at the most. Whereas in the eastern EU, the usage has doubled. So you need to be careful with taking an average growth for the whole EU.
PVT	We have the feeling that with the cross checks it is already done; we have the right order of magnitude.
DH	My suggestion is more for the projection of usage over 30 years.
LPS	I would like to clarify: we can give EU-27 data for your assessment, but this is not 60% but 80%.

Task 6 (DE)

See powerpoint presentation.

abbr.	Comment/answer
MB	Why are 'heavy metals' mentioned in this discussion [slide no. 61]? I thought we only had copper and aluminium.
DE	No, this is one of the standard indicators of environmental impact that is calculated by the Ecoreport tool.
LPS	Want to mention that this great that this indicator is included in the assessment, but it should be taken with caution and for a hotspot analysis this is alright. Because there are a lot of discussions on the method behind the assessment of this indicator and is not as strong as other indicators.
MB	I think a footnote will be useful here.
DE	In the report is mentioned that the Ecoreport tool and the MEErP methodology are used.
PVT	We can add that this has to be studied more in detail as a research recommendation.
LPS	Even with the other indicators and the graphs with the results per phase, it should be mentioned that the results need to be taken with caution. Because the Ecoreport tool is used and that isn't the best LCIA-method.

abbr.	Comment/answer
AS	What exactly is included in the production phases? Plastic, copper, from raw materials?
PVT	Yes, it is not only the copper. So the complete production of materials, including the transport and packaging, etc.

abbr.	Comment/answer
MB	What's the unit of the graph om slide 64?
DE	In the report, in the caption of each graph the unit is mentioned.

abbr.	Comment/answer
MB	On slide 67, again the rest value is not included yet. If added the simple payback period will be less. In other studies, it was recommended to keep the materials within the EU for recycling, urban mining, etc.
PVT	We will certainly mention this. We can add there is a strategic stock, making us less depend on other countries.
MB	Recycling of plastic and other materials can have also a rest value and not only used for energy production. However, this will make it more complicated.
DE	We have to see if it is possible to add it into the Ecoreport tool.

abbr.	Comment/answer
CM	[slide 70] The product price is it included in the sensitivity analysis? Or something you are going to do?
DE	Yes, to see the impact on the life cycle cost.

Continuation after the lunch break: draft Task 7 - policy options, scenario's, socio-economic impact analysis and sensitivity analysis (PVT/DE)

See powerpoint presentation.

abbr.	Comment/answer
ES	Just to complete you with regards to the losses [slide 78]. I know in certain countries, national associations have developed tools to calculate the losses, such as Norway, Switzerland, probably the UK too. So it can be used to calculate the losses directly, just by giving the right parameters.
PVT	Yes, we've seen that and some manufacturers referred to it.
ES	It is not manufacturers. It is the national association of installers; developed, maintained and managed by the association itself.
PVT	That's nice, we can add this.

abbr.	Comment/answer
PVT	Another thought is on ohmic resistance.
HM	You stress ohmic resistance, which is really fine. All the tables in the standards give the ohmic resistance in an easy to express name, for example 50 mm2. Do you think that the value of 0.187 ohms per km is helpful to decide which kind of connector you have to use, or kind of fuse?
PVT	Indeed, from practical point of view for mounting the CSA is better.
HM	Is the DC ohmic resistance helpful? And the maximum load on 20 degrees is het really running at 20 degrees? The ohmic resistance is needed at the maximum temperature. And only then a 100% load can be given.
PVT	Any ideas on this are welcome. It is not to replace important information as the CSA. It is just for having more easy accessible information.

AB	I have thought about this concept. First, the resistance needs indeed to be combined with the cross section. Then, resistance at 20 degrees or at maximum temperature; it would be better at maximum temperature, but in this way you will put high-performance insulation in a disadvantage. So in my opinion 20 degrees is acceptable for everyone. When making the dimensional analysis of resistance, you will discover that resistance is watt per m per amp. Therefor my crazy idea is not to provide resistance, but the same value but expressed in terms of watts per unit of length per amp, which allows the comparison of all cables in quite a communicative way on the same level.
CM	I think it is useful to move away from the focus on CSA, when you start to think about energy efficiency and reducing losses. If you look more at resistance than you could have more technical solutions to achieve that way, e.g. an aluminium cross section and such and such. This will encourage a more holistic viewpoint when specifying systems.
MB	I think that we can have a combination for a transitory period. It is for our group to decide how we can achieve the objective energy efficiency and which parameters to use and which path to take.
HM	Sorry, it is different. A lamp or a final use appliance is the end of the whole chain. The cable is something in between that needs clear communication with all electrical parts to which the cable is connected. So for installing the cable it is important to know what the connection points are.
MB	How else can you motivate a designer to think about the energy efficiency of a cable?
CS	It will be highly unlikely that the Commission will propose an Ecodesign regulation with information requirements only. The normal way around is that you have hard requirements on energy efficiency that makes economic sense and then you can think about information requirements on top, which don't have to make economic sense per se as there is already regulation.
PVT	Okay, please provide use ideas.

abbr.	Comment/answer
CM	In case of the application of minimal energy performance, it doesn't need to be focused on a ban, for example of small CSA. It can focus instead on the losses in installed circuits, e.g. all industrial installed circuits must not exceed 5% losses. So rather than focussing on CSA, you focus on performance of a circuit.
PVT	Yes, this maybe can be combined with the idea on information requirements.
CS	Even if we stretch the limits of the Ecodesign directive to that extend, we would be challenged by the free moment of goods. What would be the case of harmonising that on EU level? Which I can't see.
CM	Another option is the adoption of voluntary agreements. To avoid the regulatory issues on a flexible way.
CS	Who would be in charge of that? The European installers' organisation?
PVT	We can add this idea.

abbr.	Comment/answer
BS	If the definition of 'a product' would include services as well this could make a difference. So that the installation can be included as well. In Ecodesign I think only a good is a product, which is different from standards that refer to a product as a good as well as a service.
CS	Let's imagine if we consider regulation, on whom will the legal obligation be? Who has to design for energy efficiency? The installers, the architect?
PVT	Every country can decide for each self. There is also no decision yet that this should be decided at European level.
CM	Another in Ecodesign is energy labelling. Is there an option to label circuits?

PVT	A possibility is to include it in the EPBD.

abbr.	Comment/answer
FN	Should the legal obligation be on the one who makes the calculations?
BS	But the installer can install something different than what was designed.
PVT	In principal, the installer is the one who brings a product on the market. He makes the final delivery to the end user.
MB	Can't you make the one who is responsible for the safety also responsible for the energy efficiency?
PVT	In some countries that is the case and the certifier has the final responsibility. But what about the manufacturer? We need to state in the reports who are the responsible parties and what does it imply?
CS	There is an additional complication. The requirement cannot be verified in the product itself, making it hard to rely on self-certification. Meaning that you need third-party certification and increase in compliance costs, which is difficult to convince Member States.

abbr.	Comment/answer
CF	It's interesting to have analysis on how the EPBD can help, but little legitimacy to do so, as the point of this study is to see what can be achieved with Ecodesign and not to shift that to EPBD.
PVT	We are bringing up the idea.
BS	To confirm, is it that we cannot do Ecodesign because we cannot discriminate between professional cables and household cables? Meaning that lower CSA cannot be band?
PVT	Yes, but there are always applications in the industry sector that uses small CSA too.
CS	In the power transformers study, we had a similar discussion. Where we came to the conclusion that the best way forward was to make TCO embedded in their tendering processes mandatory for utilities, as each transformer has unique design specifications. This was agreed on by all, but this isn't something that can be done with the Ecodesign directive because it is addressed to manufacturers when they place products on the market. The question is, in the transaction between the one who designs and the one who installs the circuit, how can we make sure that they take into account energy efficiency over and above safety? The transaction governed by private law, in contract, so maybe the best way is not by regulation. Will the standard alone suffice to make sure that energy efficiency will always be taken into account?
ES	I think it all depends on the client.
CS	What drives the award of contracts? Is it purely on costs? Or is the one who puts the contract out requiring that energy efficiency is taken into account? Is there a driver for this?
ES	Installers will respond on the demand. It is not requested. More and more technical solutions on the field of energy efficiency are done, but not automatically. On the other side, there are already energy-efficient technical solutions that are proposed to the client. The rest is negotiable between price and the willingness to invest in technical solutions.

abbr.	Comment/answer
BS	For plastics, if you manufacture a cable how many plastics, flame retardants and other additives goes in there? What does it depends on?
AS	I think this is out of the scope of this study. Therefore we did not provide any detailed information on recycling.
CS	The question is, is there anything that can be on regulation to improve the way

	cables are recycled?
AS	No, as already explained, the copper value is very high. So as soon as cables come available on the market at the EOL and they are collected, the copper will be recycled. Resulting that the plastics come available as well. But only if there is an economic viable way to recycle the plastics, than the plastics will be recycled. This also depends on the type of plastic market, who the recycling is organized e.g. PVC is very well organized. But it will not always go to a recycling company.
BS	Can a manufacturer easily switch day by day which type of plastics it uses?
AS	No, it is well specified.
BS	Is it then possible that manufacturers only commit to using only one type of plastics?
AS	No, that isn't possible, due to safety issues and fire resistance specifications. It depends very much on the specifications of the customer and the applications of the cable. But the problem with EOL recycling is not only the substance of the plastic itself, but also the contamination by the shielding of the cable when splitting the cable.
CS	So the only secondary use of plastics is downgrading?
AS	Yes
CS	Is there anything that can be done at the design stage of the cable without compromising the properties of the cable and would prevent downgrading?
HM	No, there too many causes. If the insulation material is used with a chemical modification of the properties, for example heat treated to get cross linked for certain mechanical strengths, than the material cannot be used again. It cannot be extruded again. Another material, the volume of it is too small.

abbr.	Comment/answer
CS	We need a better characterisation of different policy options. Not with comparing labelling with labelling, and BAU and Ecodesign. Go deeper into the characterisation of the different policy options. It isn't up to you to decide whether or not to go for Ecodesign. Putting that a side, what would be the savings with an Ecodesign scenario?
PVT	Yes, indeed. But we can also use your feedback on the options. The first step is to identify the presented policy options better, followed by how they are linked to the scenario. Of course, the weaker options will always have uncertainties whether they will be implemented.
CS	You have been through this before in the transformers study.
PVT	With the transformers we were surer on the loading.
CS	Just make assumptions and document it.

abbr.	Comment/answer
CS	What the directive says is that the requirements should be set on the level of least LCC or similar, so the magic figure we need is the difference between BAU and the least LCC. Whether it is feasible or not, that is a separate question, and whether that can be archived with the Ecodesign directive is a different question. But that in itself has a lot of value, when we are talking about half a TWh than we can go already, when talking about 50 then we're talking.
BS	That is why I was wondering why you didn't take for scenario IV: the Ecodesign scenario, D3, BAU, leaving BC 2, 3 and 6 out.
CS	There is potential but difficult to tap.
BS	Slides 81+82 on policy options are to unclear.
PVT	Yes, the options were not linked but will be more commented in the final report.

Conclusion of the stakeholder meeting: the policy options needs to be reworked and depending on that redo the rest among which the sensitivity analysis.

- Any other business

Planning stakeholder feedback and finalization (all)

Deadline for stakeholder comments, input and position papers: Saturday 20 December 2014.

ANNEX E MINUTES OF THE MEETINGS WITH EUROPACABLE

Date :	28/10/2013	Ref.	ETE/N3582/2013-00XX
From :	Paul Van Tichelen, Marcel Stevens	Annexe(s) :	
To :	Cesar Santos		
Copy (CC):	Dominic Ectors		

Subject : Meeting with Europacable on scope

- **Present**

Contractors:
Paul Van Tichelen, technical project manager power cables, VITO (Belgium)
Marcel Stevens, expert power cables, VITO (Belgium)

Stakeholders:
- Dr. Volker Wendt, Europacable
- Annette Schermer, Prysmian group
- Friedrich Müller, Nexans, Standardization Director

- **Minutes**

Europacable: has a competition law policy for meetings, amongst others it is not allowed to exchange individual company data on e.g. sales or inventory volumes.
Europacable: In line with the letter sent (9 October 2013), Europacable suggest to have as scope "Indoor Low Voltage electrical installations".
From the title and the enquiry to installers they have deducted that the study team is moving in that direction.
VITO: For what matters accurate evaluation (point 3), VITO stated that we are working on such an approach that models electrical installation topologies and typical loads. It will be presented at the stakeholder meeting. VITO stated that the focus is ' losses in installed power cables in buildings', hence the electrical installation is taken into account.
All: Parameterization of installations and loads is not easy, e.g. distribution of loads. Length & method of installation (& ambient temperature) are important parameters.
Cable as part of the electrical installation, a clear definition of electrical installation is needed.
Nexans: has an online tool for optimizing energy savings ("Ecocalculator").
Nexans: "Allowed losses in the cable" as parameter?
Prysmian: In their rough estimates renovation rates are 2-3 % and life time 40 years.
Europacable: CSA is connected to cable resistance in line with VITOs current analysis of standards.
There is import from China/Turkey.
Problems with poor cable quality were reported in the UK by http://www.aci.org.uk/
Europacable: They had questions whether and how VITO will deal with other Ecodesign aspects compared to energy efficiency?
VITO: replied that MEErP will be followed and has a mini LCA approach on board, this means we do not look to GWP alone but it is not the intention to focus on improving other environmental aspects such as treated in the ROHS directive.
VITO: how are cables recycled and are there improvements possible?

Europacable: Cables are shredded and insulation is separated from copper afterwards, this is common technology with no improvement potential related to cable design. Burning off insulation from cables is not done anymore within the EU.

- **Actions**

Europacable: They will motivate more members to provide input to the enquiry if needed, therefore VITO will provide input without disclosing confidential information on who replied.
VITO/EC will organize a stakeholder meeting and present draft Task 1-3 status info.
In parallel with the study enquiry there is an on-going inventory of the different installation standards in the EU member states – (big) differences because of historical reasons. (This could serve as back up and/or complement for the study enquiry?).
Europacable/Nexans: can assist in providing ideas in parameters and standards.

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europacable

Notes of VITO - Europacable Meeting held at Europacable offices on Monday, 28 October 2013

Brussels, 13 November 2013

Europacable proposes to publish this document on the EDD website for public reference.

Key topics of discussion

1) Definition of scope of the preparatory study under the EDD revision

- VITO and Europacable agree that the scope of the preparatory should not be limited to “power cables” itself, but to be widened to “installation systems”.
- VITO highlights that the approach to consider low voltage electrical installation systems will however partly originate from the losses caused by cables inside installations systems. Additionally it is recognized that other parts in the electrical installation and the way the installation is constructed have impact on the losses.
- VITO highlights that the study concerns energy losses in cables in LV electrical systems in buildings. VITO recognizes that also other parts in the electrical system and the way the system is constructed impact the energy losses of the cables. The intention is to clarify that all parts in a system are interrelated and interfere with each other.
- VITO points out that the key challenge will be to model the following three dimensions:
    - The array of parameters for the installations
    - The array of standards relevant for installations at the level of all EU Members States
    - The array of safety requirements relevant for installations at the level of all EU Member States
- Europacable pointed out that the existing standards for installation systems give guidance for the selection of the appropriate cable cross section taking into account specific application parameters like
    - Requested ampacity
    - Length of the cable installed inside the system
    - Maximum allowed voltage drop
    - Installation conditions (ambient temperature, heat dissipation)
    - Maximum operating temperature for cables and the full installation system
    - Safety fuses and short circuit time
    - Number of cables per circuit

- Europacable stressed that it fully supports the EDD objective of increasing energy efficiency. Europacable member companies have internal tools available to support customers / installers to select the optimum cross section of the cable for a defined application/installation system

2) Input to VITO questionnaire for Cable Manufacturers , September 2013

- Europacable is fully committed to support the collection of data as outlined in the questionnaire, but is limited by strict EU competition requirements that need to be duly respected.

3) Actions agreed

- Europacable to inform VITO about the accuracy of the resistance measurements for conductors described in IEC 60228 (conductor standard)
- Europacable checks if standard correction factor exists for the load distribution.
- Europacable to provide links of Prysmian and Nexans tools for calculation of optimum cross sections
- Europacable to revert VITO questionnaire with maximum available information related to code designations and installer standards
- VITO and Europacable to ensure regular updates.

ENDS

In the second meeting between VITO and Europacable, held on May 13th 2014, the Europacables comments were discussed. These can be found in Annex F .

ANNEX F COMMENTS AND RESPONSES ON TASK 1 – 3 (VERSION 1)

Organisation: European Copper Institute	Name: Fernando Nuno (Fernando.nuno@copperalliance.es)	Date: 3 Dec 2013

Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
Task 1	Chapter 1	9	Summary	Agreement that focus should be on the services and industry sectors. However, for the residential, the issue remains in the very old installations (as stated in section 1.3.1.4, page 58).	Residential installations could be considered under the light of the necessity to renovate electrical installations having more than 40 years.	Proposal to consider this in Task 7, the expected impact will remain low? Is there information on the installations > 40 years? Are they significant?
Task 1	1.1.2	14	Cables within buildings	Agreement to exclude T&D networks and focus downstream the meter.	-	noted
Task 1	1.1.3	19	Proposed scope	Agreement on the proposed scope	-	noted
Task 1	1.1.8.1	25	Conductor material	Copper alloys are used only when special properties are required (improved mechanical strength or other). However, copper alloys conductivity is always below pure copper. In the context of fixed installations, such alloys are not	Delete mentions to copper alloys.	OK

				representative		Deleted
Task 1	1.1.8.2	27	Power factor	Power factor is taken = 0,8. Later in Task 3 it is indicated = 0,9	Harmonize Task1 and Task 3 (chapter 3.1.5.2 Power Factor)	OK Changed in Taks 3: PF=0.8 (IEC 60364-5-52/Annex G: in absence of precise details, the power factor is taken as equal to 0.8)
Task 1	1.1.9.7	39	Sales volume copper	According to ECI sources, 924 kTon of copper refers to projected 2030 sales for wire and cable in EU (BAU)	Remove the word "worldwide"	OK Removed
Task 1	1.2.1.1.8	49	Voltage drop and losses	"The higher these voltage drop values the higher the energy losses in the cable *(e.g. for a resistive load a voltage drop of 5% is equal to an energy loss of 5%)."* This is true, but other branches of the installation can have a lower voltage drop (because shorter lengths) and still need to be addressed in terms of energy efficiency. Reducing the maximum voltage drop has proved to be only partially effective to reduce the global losses in an electrical installation (a dedicated study by Egemin exists, available under request to ECI)	Consider the limited impact of voltage drop reduction on global energy efficiency.	Noted Voltage drop reduction has an important impact on energy efficiency of the electrical distribution system. Even as the location of the switchboards, Power factor correction systems, reduction of the harmonic

						currents… **Is there a diversity factor in the voltage drop calculation?** **(policy measures are in Task 7)**
a	**1.2.1.2**	**54**	**LV installations – Periodic Verification**	**Periodic verification could be further developed in the residential sector, so as to address the old, unsafe and inefficient electrical installations.**	**-**	**Noted**
Task 1	**1.2.1.3**	**54**	**New standards**	IEC TR 62125 Environmental statement specific to IEC TC 20 – Electric cables "Annex A.4 Considerations for use and end of life phase [...] 2) Has information been given to the user on the fact that the choice of transmission/distribution voltage and the **conductor cross-section will seriously influence the current transmission losses**?" This TR might evolve into a standard in the years to come.		**OK** **Added** **Please provide a copy**
Task 1	**1.3.1.4**	**59**	**Voluntary initiatives**	**The European Forum for Domestic Electrical Safety – FEEDS – calls for safe and modern Electrical installations in dwellings. -** http://feedsnet.eu/home Consider addressing the oldest installations in the residential sector.		**Noted**

				ECI can provide further information on safety figures. http://www.safetybarometer.org/ , and additional information on request.		
Task 2	**2.1.3**	**11**	**Copper sold for use in power cables**	**ECI best estimate is already reflected in the Study for the Amended Ecodesign Working Plan (reproduced later in the report)**		**Noted**
Task 2	**2.2.2.2**	**14**	**Year of statistics of table 2-8**	**ECI will contact Ecofys to provide feedback on the year of such statistics**	**-**	**Noted**
Task 2	**2.2.5**	**20**	**Growth rates**	**Table 2-18. When applying such rates (2.1% + 7.08% for Services and 3.1% + 7.08% for industry), the energy savings potential becomes much larger than initially estimated in the Amended Ecodesign Working Plan (assumed at just 3% growth rate).** **Under these assumptions, savings at 2030 horizon would roughly be multiplied by 3 compared to the Amended Ecodesign Working Plan.**	**Harmonize energy savings estimation at 2030 using the corresponding growth rates.**	**Will be in later tasks**
Task 2	**2.3.1**	**20**	**Copper mines in Europe**	**"**In Europe the largest copper Mine is located in Bulgaria (110000 metric ton per year). Production of copper in Europe is mainly located in Belgium (118000 metric ton), Bulgaria (284000 metric ton) and Germany (591000 metric ton) (source: US Geological Survey)." **This information is inconsistent with ECI /** *European Minerals Statistics, 2013* **source. Please, consider:** http://www.copperalliance.eu/industry/economy	**Use alternative information sources.**	**Will be updated**

Task 2	2.4.1	21	Purchase price	**Original quote** *"Copper is becoming a scarce resource and an increased demand caused by the use of wires with an increased cross-sectional area may result in even higher market prices."* **This regulation is estimated to impact, as an average, between 0.08 and 0.6 MTons / year (probably less), compared to a global demand of 24 MTons / year. Cu is a global commodity traded on the LME, which fixes its price; trying to forecast price is not appropriate.** **As for copper scarcity, please note that according to USGS data, since 1950 there has always been, on average, 40 years of copper reserves and over 200 years of resources left. - See more at: http://copperalliance.org/core-initiatives/sd/economy/long-term-availability-of-copper/** http://copperalliance.org/wordpress/wp-content/uploads/2013/06/ica-long-term-availability-1303-A4-lr.pdf **Finally, it should be considered the high recyclability ratio of copper, especially from used cables. Find more at http://copperalliance.org/core-initiatives/sd/environment/recycling/.** **According to the International Copper Study Group (ICSG), 41.5% of the copper used in Europe comes from recycling. http://copperalliance.eu/about-copper/recycling** ***3.1.1.1 A comprehensive study of the stocks, flows and recycling rates for copper has been developed by the Fraunhofer Institute. This complex, three-year study has resulted in an improved understanding of how copper is used and re-used by society:***	**Avoid considering copper as a scarce resource.** **Avoid forecasting commodity prices.**	**Will be updated**

				http://pubs.acs.org/doi/ipdf/10.1021/es400069b		
Task 2	**2.4.3**	**22**	**Installation costs**	**ECI will provide some figures estimated by Egemin on the basis of the previous studies.**		**Noted** **If possible provide an installation cost model**
Task 3	**3.1.1**	**12**	**Definition of user**	**Agree with the complete list of users at different levels. It is important to make a clear distinction between the owner and the user (necessary to address the split incentives issue)**	**-**	**Noted**
Task 3	**3.2.1**	**36**	**Building heating and cooling**	**Agree to neglect effects on heating or cooling of the building**	**-**	**Noted**
Task 3	**3.4.1.3**	**37**	**Refurbishment occasions**	**House sales are indeed a good opportunity to renovate electrical installations. Some good examples exist (France for instance -** http://fr.wikipedia.org/wiki/Diagnostic_%C3%A9lectrique**).** **ECI has a comprehensive study on such schemes in various countries. Available on request.** **Services and industry, as stated in Task 1, present higher rates of renovation.**	**-**	**Please provide**
Task 3	**3.4.2**	**38**	**Lock-in into existing**	**Agree that in industry and services this barrier is quite**	**-**	**Noted**

			installations	**limited.**		
Task 3	**3.4.2.2**	**38-39**	**CO2 emissions**	**From Amended Ecodesign Working Plan:** The emissions per amount of copper produced are fixed at 2.95 kgCO2 eq./kg CU produced. From Spanish Cable Maker Association: http://www.facel.es/docs/420-Tabla%20emisiones%20CO2.pdf		**CO2eq is an issue of later taksk**
Task 3	**3.4.2.2**	**38-39**	**Increase in volumes and impact on price**	**Estimated increased demand (between 0,08 and 0,65 MTon/year) corresponds to the impact over residential and non-residential. Leaving residential sector aside, the impact would be lower, between 0,05 and 0,42 MTon/year.** **See previous comment to Task 2 chapter 2.4.1**		**Impact will be assessed later (Task 7)**
Task 3	**3.4.3**	**41**	**Software**	**“design tools have to be adapted by software development companies”** **Indeed, but already some software exist including energy efficiency analysis (find table below).** **For services and industry, integrated software is the common choice. The new design guidelines would simply be integrated by updating the software tools.**		**More text will be added**
Task 3	**3.4.3**	**41**	**Extra training**	**In the perspective of implementing a regulation on services and industry only, extra training might be required for design engineers, but probably not much for installers.** **Extra-training needs would be however quite limited, as the software takes in charge the energy efficiency aspects.**		**Text will added**
Task 3	**3.4.3**	**41**	**Impact on installation**	***“****Installation time and related cost may increase due to extra wiring or more difficult handling of cables with larger sizes”*		**Noted, this is an issue for**

				This would have an impact on installation time (see previous remark to Task 2 – Chapter 2.4.3), but this would also translate into additional employments (direct + indirect).		**Task 7 (impact)**
Task 3	**3.4.3**	**41**	**Certification**	**Indeed, certifiers should verify that the installation has been designed according to the updated rules.**		**Noted**

Software	Manufacturer	Economic sizing Standard	Optional	External	Remarks
Caneco BT	ALPI Software	No	Partly Investment estimation only	Yes, through export and import to and from external processing (proven)	Modular software, features depend on actual licensed configuration
TR-ciel (legacy) Elec Calc	Trace Software	No	Partly Investment estimation only	No clear information on export and import facilities	Features depend on installed options (TR-ciel) Unclear for successor Elec Calc
Kitgoni	Kitgoni SPRL	Yes	/	/	The URE module (Utilisation Rationnelle de l'Energie), is standard included, the user only has to choose to use it.
Simaris design	Siemens	No	No	No	Import & export facilities can be extend through Simaris project software
Ecodial	Schneider Electric	No	No	No	
Solutions Electrical	Solutions Electrical UK	No	Partly Investment estimation only	No	

Organisation: Danish Energy Agency/Norwegian Water Resources and Energy Directorate	Name: Anne Svendsen (Viegand Maagoe, Denmark)	Date: 25.02.2014

Ref.	Document comment relates to	Section -	Page	Topic	Comment	Proposed change	VITO
1	Task 1 report	Chapt. 1 task 1 scope	9	Scope	Therefore it is proposed to focus in the subsequent tasks on the services and industry sector circuits. Page: 36, in multi-dwellings the level 1 circuits can be considerably long and can contribute significantly to the losses in the electrical installation in residential dwellings.	Ecodesign requirements will apply to power cables when they are placed on the market. When the cables are placed on the market, it is not known in which sector the power cables will be used. Therefore requirements should cover power cables intended for use in all buildings including residential buildings. Furthermore on page 36 the potential for multi-dwellings is estimated to be considerable. Therefore the residential sector should not be taken out of the scope	Partly agreed, text added in section 1.1.9.7: When the cables are placed on the market, it is not known in which sector the power cables will be used and therefore residential cables should be in the scope of Tasks 1, 2 and 7 (partly) but not for Tasks 3-6 on environmental improvement potential..
2	Task 3 report		37	Recycling		Figures from Denmark for recycling of copper are in the order of 80%	Section is updated. MEErP uses fixed values for metal recycling. Land fill is only 5 %, We will inform however the EC about this relative poor copper recycling in Denmark compared to MEErP averages. An explanation would be welcome.

Organisation: Europacable Name: Volker Wendt Date: 14 January 2014

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
1.	Task 1 report	All	All	General	The transparency and reference of data used needs to be improved	All sources and data should be shared among stakeholders. We would recommend using publically available data source such as MEErP methodology Part 2, as well as EUROCONSTRUCT and EUROSTAT data.	Data will be shared among stakeholders, unless they are confidential . We use publically available data
2.	Task 1 report	All	All	Review	Provides lines in the document to improve the list of comments	Add lines on the draft document.	Accepted Changes to the text will be marked by a green background
3.	Task 1 report	All	All	Review	The title on the top of each page is "list of acronyms"	Modify the top of pages of all the document	Accepted – Removed
4.	Task 1 report	List of Acronyms	VI	Acronyms	Not all acronyms are listed. For instance, kd factor is not mentioned. Moreover, some acronyms can be used for two different words (S)	Review list of acronyms : -by adding the missing ones - by replacing some of them so that one acronym cannot be used for two different signification.	Accepted Added Remark: "S" is used for Apparent Power & for the nominal cross sectional area of a conductor (this is also the case in the standards)

5.	Task 1 report	Chapter I	9	Summary	The scope is mentioned to be “losses in installed power cables in buildings”. Considering that cables consume energy depending on the way they are installed and on the final application they are connected to, the scope should focus on the “installation system” and not on “losses in cables” We do recommend to switch the scope from “losses in installed power cables in buildings” to “ electrical installation system in buildings”	Review the scope of the study	Partly accepted: We will take into account the whole electrical installation. But as stated in the Work Plan, the main focus will be on the fixed wiring because this is the most relevant element of the electrical installation for energy efficiency purpose.
6.	Task 1 report	1.1	11	Highlighted sentence on energy systems	For power cables; the installation system is entirely affected by the choice of the power cables. Installation system should be included in the scope also. See above the recommendation on scope modification.	Review the scope of the study	Partly accepted: Installation system, ambient conditions… do have an impact on the cable section. This is already mentioned in the study.
7.	Task 1	1.1.2	14-17	Scope	Norway : As IT-systems for 230 VAC installations are valid in Norway, more screened installation cables are in regular use = safety aspect (National Product Standards. NEK 535, 591 and based on CLC 603, 604, 627, EN 50525)		Accepted Added in the text (on page 16)

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
8.	report						
9.	Task 1 report	1.1.2	15	Insulation description	It is mentioned that the insulation of the cable is made of an insulation of the conductors and an outer insulation sheath. The outer sheath has no insulation purpose. It is thus not called "insulation sheath" but "sheath"	Review the cable description and differentiate insulation from sheath. Delete the word assembly and the last sentence	Accepted "Insulation" removed
10.	Task 1 report	1.1.2	16	Electrical losses	Cables losses are not called "copper losses". Such losses will exist whatever the material of the conductor, as for instance for aluminium.	Remove "or copper losses".	Accepted "copper losses" removed
11.	Task 1 report	1.1.2	16	Shield Fig 1-3	This is a commonly used cable in industries and residential buildings in Sweden	**Change to:** This is ~~not often~~ used in electrical power cables within buildings, ~~it is mainly~~ and used in instrumentation signal cables.	Accepted Changed (page 16)
12.	Task 1 report	1.1.2	17	Electrical installations in buildings	For the related installation and products the IEC standards 60364, 60227 and 60245 are mentioned	The relevant European Standards should be mentioned but information is also necessary, that there may exist national rules and products deviating from IEC or European Standards.	Accepted Added (page 17) *Please provide us more information about the electrical installation rules at member state levels, so we can add it in the report.*

13.	Task 1 report	1.1.2	17	Scope	Norway : NEK 400 is based on IEC 60364, but with National deviations, as for example requirement for bigger conductor cross-sections, i.e. 2,5mm² instead of 1,5mm², etc., with following downsizing of circuit breakers to take into consideration the relatively high electrical energy used for electrical heating by electrical ovens or heating cables, due to good availability of GREEN Hydro energy, and the fact that the losses in transfer of electricity is much lower than the losses using hot water as energy source. The minimum conductor- and short circuit breaker requirements are set due to less risk of overheated		Noted

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					cables/connection, which again could be basis for fires, not today to reduce energy consumption. Well thermally insulated buildings are the most effective way to minimize the energy needed for heating!		
14.	Task 1 report	1.1.3	19	Scope	As mentioned above, scope should be modify by "installation system", to take into account the effect of the product on the all energy system (electrical installation), as mentioned in the methodology. Scope can not only focus on "losses" but should have a global vision, and thus concern a system and not losses. Moreover, the methodology recommend a global life cycle view, not to transfer pollution from one phase to another or from on media to another. It is recommended to use Life Cycle Assessment process with transparent data and methodology.	Review the scope of the study. The objective should be to minimize the environmental impact of installation systems by reducing electrical loses in installation systems but taking also into account all related adverse environmental impacts for bigger cable cross sections It should also take into account the total life cycle cost related to any potential changes of electrical cables. Carry out LCA and LCC analysis, taking into account the different life cycle steps and various environmental indicators.	Text added explaining that the electrical installation is taken into account at system level and a reference is added to Chapter 3 for more details on this approach.
15.	Task 1 report	1.1.3	19	Scope	The first two paragraphs do not have the same scope mentioned	Harmonise the two paragraphs with the same scope.	Accepted Done

16.	Task 1 report	1.1.3	19	Scope	The term “building” should be clearly defined somewhere. Are all buildings concerned, like Nuclear power Plant or Oil and Gas industry for Instance, which can be considered as an industrial building? In that case, additional standards for specific application should be added in 1.1.5	Provide a definition of buildings concerned by the directive or the list of buildings that are out of the scope. If necessary, complete the list of standards with the ones existing for specific applications.	Accepted Information added under 1.1.3
17.	Task 1 report	1.1.3	19	Scope §3	“or non-insulated “ : Non insulated LV cables do not exist for safety reasons	Remove “or non-insulated”.	Accepted Removed
18.	Task 1 report	1.1.3	20	“fixed wiring”	Both single core and multi-core cables can be installed in buildings.	Remove (single core) in the “fixed wiring” paragraph	Accepted Removed
19.	Task 1 report	1.1.3	20	Remark	The remark should mention that the word cables will be used for “power cables”	Add “power” in the remark: “...as a general term for insulated *power* cables....”	Accepted Added

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20.	Task 1 report	1.1.3	20	“Outside of the scope” §1	The potential increase of cable cross-section will induce : - Higher energy consumption for conductor, insulation and sheath as well as packaging - Higher transportation impact due to higher product and packaging weight - Higher energy consumption related to end of life.	Include the other life cycle steps to be reviewed as modification of cable size will have a negative impact on them.	Noted This is the purpose of Task 6.
21.	Task 1 report	1.1.3	20	“outside of the scope” §2	Lift cables and safety cables are mentioned as outside of the scope. A definition of lift cables and safety cables should be provided as they are part of the electrical installation system.	Provide a definition of lift cables and safety cables that are out of the scope. It may be also the place to exclude specific buildings (e.g. NPP)	Accepted Added in the text: “In general these are special purpose power cables which are not fixed wired (flexible lift cables) or have very low load currents (cables to fire detectors, data cables..)”.
22.	Task 1 report	1.1.3	20	“outside of the scope” §2	“socket-outlets, junction boxes, cable installation system, ...” are mentioned as outside of the scope. Considering the negative impact of the proposed policy measures on the installation system, such part should be included in the scope	Include the installation system in the scope OR Include this line “socket-outlets, junction boxes, cable installation system” in the paragraph above to ensure that the negative impact of the proposed policy measure on such equipments will be taken into account.	Accepted “socket-outlets, junction boxes, cable installation system” included in the paragraph above

23.	Task 1 report	1.1.3	20	"Outside of the scope" §1	The building construction should be mentioned in this chapter. Any modification of the cable diameter will have a negative impact on the building design.	Include the building design and construction on the list of topics outside of the scope but with negative impact related to the proposed policy measures. "	Accepted Added
24.		1.1.5	21	Categories	Cable classification and IEC responsibility is slightly different	IEC TC20 WG 17 is in charge of LV cables (below 1kV). 1kV cables are in the responsibility of WG16	Accepted Changed
25.		1.1.5	21	Categories	There are many product standards mentioned which are not relevant for fixed installation products	Delete references to products out of the defined scope (fixed installation), inform that there are also European and national product standards	Accepted Not relevant references deleted Noted
26.	Task 1 report	1.1.7	24	Functional unit	As mentioned in ISO 14040, the functional unit should be "quantified", to ensure comparability. It should include the current carrying capacity, as well as quantification of the product itself, the lifetime, use conditions, and standards the product fulfils. The list of standards allows comparing specificity of identical cross-section, having for instance different fire properties.	Proposed functional unit for cables : "transmit energy expressed for X A over a distance of Y km during Z years and a W% use rate, in accordance with the relevant standards AAA, BBB, CCC , DDD"	Rejected FU= so called Single parameter. Length of the cable, use rate,.. are secondary performance parameters

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27.	Task 1 report	1.1.8	24	Secondary product performance	Lifetime should be included as a secondary product performance.	Add Lifetime as a secondary product performance parameter.	Accepted Added
28.	Task 1 report	1.1.8	24	Nominal Cross-Sectional Area (CSA)	Reference to US-standards AWG is not necessary		Accepted Standard added
29.	Task 1 report	1.1.8.1	25	Conductor Material : Note	Such alloys are not used in buildings application, so the note is not relevant.	Note to be deleted..	Accepted – Deleted
30.	Task 1 report	1.1.8.1	25	Number of core in the cables	The second layer is not insulation but a sheath. Is has no insulation properties.	Rephrase by using sheath instead of "2 insulation layers" and "globally covered by an insulation protective material".	Accepted Changed
31.	Task 1 report	1.1.8.1	25	Number of core in the cables	Earth can also have smaller size	Add "earth" after "neutral"	Accepted Added
32.	Task 1 report	1.1.8.2	26	Electrical installation system	The short-circuit intensity is not mentioned. It is also a criteria for cable selection	Add the short circuit intensity as a criteria for	Accepted Added

33.	Task 1 report	1.1.8.2	26	IB	Does "IB" in the voltage drop paragraph and "Ib" in the lad current paragraph are the same? If yes, always use the same script for a given acronym. If yes also, do not used different words for the same acronym : "IB : Design current" and "Ib : Load current?"	Always use same acronym : IB or Ib Always use same definition : design current or load current Include Ib (or IB) in the list of acronyms at the beginning of the report	Accepted Changed
34.		1.1.8.2	26	Installation cable length	Installation cable length: the total length of cable used in the electrical installation as the sum of all circuits;	Misleading. To be clarify.	Accepted Clarified
35.	Task 1 report	1.1.8.2	27	V3	Does V3 in the equation means "cube root"?	Clarify the equation.	Accepted Clarified (Square root)
36.	Task 1 report	1.1.8.2	27	I circuit	Two acronyms are mentioned for the same definition : limit the acronyms to 1 per definition	Remove "I circuit."	Accepted (Imax removed)

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37.	Task 1 report	1.1.8.2	27	Load form factor	Mention where this definition and calculation comes from.	Add the reference of the formula.	Accepted Added
38.	Task 1 report	1.1.8.2	27	Load form factor	Prms and Pavg are not defined	Add the definition and potential formulas for Prms and Pavg.	Accepted Added
39.	Task 1 report	1.1.8.2	28	Equivalent operating time'	Load current is referred as I(t); According to definition page 27, it should be referred as Ib(t)	Check the homogeneity of acronyms in all the document and formulas.	Accepted Changed
40.	Task 1 report	1.1.8.2	28	Loss load factor	The loss lead factor is not defined in the document. Add the definition and potential formula for the loss load factor.	Add loss load factor definition and formula	Sentence is removed as the loss load factor isn't used in the report.
41.	Task 1 report	1.1.8.2	28	Loss load factor	Mentioned "for the derivation of the loss load factor, in μ". What means "in μ"?	Check the sentence	Sentence is removed as the loss load factor isn't used in the report.
42.	Task 1 report	1.1.8.2	28	Power factor	PF is defined as the power factor. Power factor is already mentioned in page 27 as Cos ϕ. Is it the same power factor? If yes, use a single acronym for the same definition all along the document	Clarify the acronym to be used for power factor : Cos ϕ or PF	Accepted Cosφ is used
43.	Task 1 report	1.1.8.2	28	Power factor	Refer to the standard the definition and formula of power factor is extracted from	Refer to the standard for power factor definition	Accepted Standard added
44.	Task 1 report	1.1.8.2	28	Power factor	"Apparent Power (S-VA)" : No definition of apparent power nor S nor VA is mentioned anywhere	Add the definition (and reference) of apparent Power Explain what is S Explain what is VA.	Accepted Added

45.	Task 1 report	1.1.8.2	29	Conductor Material purity	Purity of copper and resistivity is fixed in standards.	Material purity is not relevant here as standard request specific conductivity (conductor resistance values)	Accepted Removed
46.	Task 1 report	1.1.8.2	29	Performance related to the use	The properties of the cable should be mentioned in this part, such as fire properties , oil resistance, halogen-free, ..., which are criteria for cables selection	Add the other properties of the cables, specified by the standards and that appear in their list of requirements.	Accepted Done
47.	Task 1 report	1.1.9.3.1	31	Table 1-4	The market data source of the table value is mentioned to be from European Copper Institute but no Publicly available information have been found on such data.	Provide the document on cables sales by ECI. Each time data are used, refer to task 2 report with clear information on source..	This chapter is a first screening. A detailed calculation will be provided in the tasks 4 till 7. Chapter 1.1.9.3 looks at the Working plan which is publicly available. The study on which the working plan is based, is now also publicly available. (http://www.leonardo-energy.org/white-paper/economic-cable-sizing-and-potential-savings). Extra reference to this study is added. This and following comment s on the first screening will be taken into account in tasks 4 till 7.

48.	Task 1 report	1.1.9.3.1	31	Table 1-4	Values for residential Industry and services are based assuming sales for (industry + services) = 1.5 times sales for building. Where this 1.5 comes from? Source? Once the 1.5 time applied, the ratio between industry and services is fixed and set to 47% for services and 53% for industry. Where this ratio comes from?	Provide more transparency on the table value, by using publically available information (or provide the reports), and by explaining and justifying the calculation methods when existing.	See comment above.

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49.	Task 1 report	1.1.9.3.1	31	Table 1-4	To calculate the sales of power cables for residential, an assumption of 30kg/household is assumed, whereas the 1.1.9.4 mention that the total amount of copper in the model is 25kg/100m² and that the average floor area for a residential building is 84m², leading to 21kg/hh.	Data source should be provided on total amount of copper per hh.	See comment above.
50.	Task 1 report	1.1.9.3.1	31	Table 1-4	If total amount of copper in residential area is used to calculate the kt of copper : - By using MEErP data on number of hh (204 663 000 in 2004) - By assuming 21 or 30kg of copper per hh This leads to - 4297 ktons of copper for 21kg/hh - 6139 ktons of copper for 30kg/hh So respectively –39% and – 12% compare to values for 2005 of table 1-5	Assumptions have a great impact on the conclusion. Provide transparency on assumptions, data, data's source and calculation method used.	See comment above.

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51.	Task 1 report	1.1.9.3.1	32	Table 1-5	Values for residential Industry and services are based assuming sales for (industry+services) = 1.5 times sales for building. Where this 1.5 comes from? Source? Once the 1.5 time applied, the ratio between industry and services is fixed and set to 42% for services and 58% for industry. Where this ratio comes from? Why the ratio between industry and services is different for sales of power cables and for stock of power cables? If ratio of sales is different for this two application and differs from the one of stock, then ration of stcoh for industry and service cannot be constant. Rk : on Chapter 6 of MEErp methodology , the main buildings types per floor area are : 51% residential, 31% tertiary and 14% industrial, which differ from proposed values;	Provide more transparency on the table value, by using publically available information (or provide the reports), and by explaining and justifying the calculation methods.	See comment above.
52.	Task 1 report	1.1.9.3.2	32	Table 1-6	The document referenced for table 1-6 does not provide the electricity consumption per application. It provides : - Final energy demand per fuel (solids, oil, gas, electricity, ...) - Final energy demand by sector (industry, residential, tertiary, transport) Where do the values in table 1-6 come from?	Explain where the value from table 1-6 come from and provide calculation used.	See comment above.

53.	Task 1 report	1.1.9.3.2	32	Table 1-6	What does the total Energy (PJ prim) stands for? If it corresponds to total EU energy demand, including all fuels, it does not correspond to the value given in the reference document.	Clarify and modify Table 1-6 using the reference document.	In processing
54.	Task 1 report	1.1.9.4	33	Review of losses	"...models have been worked out based on empirical findings". The objective of the report is to provide detailed, verifiable and transparent calculation to confirm or infirm the interest of ecodesign measures on products. They should not be based on "empirical findings" without source of information and agreement of hypothesis by stakeholders.	Provide transparency on hypothesis, calculation and data source.	Very limited data on the number of circuits, length of each circuit, cable size , used circuit breakers in buildings in Europe is available. Therefore some assumptions and hypothesis have to be used. The values for these assumptions for the residential respectively services model in this first screening are mentioned in table 1-7 and 1-8.

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55.	Task 1 report	1.1.9.4	33	Review of losses	"...upon the answers on the questionnaire for installers". The summary of the installers answer has not been documented and communicated	Please make available the report on installers' feedback.	Aggregated values from the surveys were presented on the first stakeholder meeting and can be found on http://www.erp4cables.net/node/6 . Also table 3-5 and 3-8 in Task 3 provide the results of the queries on length of and number of nodes per circuit type.
56.	Task 1 report	1.1.9.4	33	Loss ratio	Iavg is not defined yet.	Provide definition of Iavg and calculation method.	Accepted Added
57.	Task 1 report	1.1.9.4.1	33	Residential cable losses	The Egemin report does not include the residential application. Where does this part comes from? How have been the different assumptions decided?	Provide transparency on the assumptions and calculation used	1.1.9.3 is based upon the Egemin stud(now publicly available, see comment 47). 1.1.9.4 is a check that VITO did with our own assumptions and models.
58.	Task 1 report	1.1.9.4.1	33	Residential cable losses	MEErP methodology (Part 2 – Chapter 6) informs that "to avoid that in further studies these efforts have to be made again, the chapter 6 provides an overview of reference data that can be used". Data from MEErP should then be used instead of other data.	It should be considered to use datas extracted from MEErP methodology	Accepted, if data is available.

59.	Task 1 report	1.1.9.4.1	33	Copper amount	It is mentioned that the copper amount of the model is 25kg/100m² . What is the assumption of the model area? 84m² as the average floor area?	Please provide the value of the average floor considered for the calculation and check that it fit with the quantity of cables installed.	m² is changed according to MEErP.
60.	Task 1 report	1.1.9.4.1	34	Table 1-7	No information is provided on how the calculations have been done, what are Imax, cable resistivity? How are Kf, Lf, Kf, PF determined? Which hypothesis	Provide more information to explain how calculation have been done of each line of the table and how assumptions have been decided (like for kd for instance).	In processing
61.	Task 1 report	1.1.9.4.1	34	Table 1-7	Separate the two RESL2L and RESL2S circuits, as it is done for the two RESL2D circuits.	Separate the two lighting and socket circuits, as it is done for the two dedicated circuits for better clarity.	In processing
62.	Task 1 report	1.1.9.4.1	34	Table 1-7 and Table 1-8	The distribution circuit length has not been filled by installers according to task 3 report. Where do the 30meters come from?	Provide source of hypothesis and calculation when necessary.	In processing
63.	Task 1 report	1.1.9.4.2	35	Table 1-8	Length of the circuit has been estimated to 30 to 35m based on installers' answers. How the number of circuits has been estimated?	Explain the way the number of circuits has been estimated.	In processing
64.	Task 1 report	1.1.9.4.2	35	Table 1-8	Like for table 1-7, No information is provided on how the calculations have been done, what are Imax, cable	Provide more information to explain how calculation have been done of each line of the cable and how	In processing

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65.					resistivity? How are Kf, Lf, Kf, PF determined? Which hypothesis	assumptions have been decided (like for kd for instance).	
66.	Task 1 report	1.1.9.4.3	35	Estimated industry sector cable losses.	Considering the choice of a cable section is based on : - Max intensity needed by the equipments - Voltage drop that can lead to higher cross-section than the one defined previously - The short-circuit intensity that can lead to higher cross-section than the one defined previously - The maximum admissible cable length How can it be concluded that the losses will be between 1 and 8%, without any industry building data or calculation?	Justify such assumptions provided without any calculation. Provide transparency and reliability on the calculation done.	In processing
67.	Task 1 report	1.1.9.4.4	35	Summary of estimated losses	An average of losses of 2% is given : - For residential and services, explanations of calculations and assumptions are missing. - For industry sector, no calculation have been provided	Explain the calculation for mean 2% losses.	In processing
68.	Task 1 report	1.1.9.4.4	36	Summary of cable losses	"most of the installers (75%) ...." : Make publicly available the report based on installers answers.	Provide report of answers from installers.	Rejected because of confidentiality
69.	Task 1 report	1.1.9.4.4	36	Summary of cable losses	Losses for residential buildings and Industrial/Service buildings are calculated with different methodology	Use same methodology for both building areas (residential and Industry/Service)	In processing

70.	Task 1 report	1.1.9.45	36	Potential improvement	A section increase of S+1 or S+2 or even higher is technically feasible on the power cable side. Nevertheless, such cable size increase is not always feasible on a building side, considering infrastructure and equipment modification	Provide a technical evaluation considering the all building on such proposed measure to evaluate the level of size increase which is feasible technically considering building and equipments.	In processing
71.	Task 1 report	1.1.9.5	36	Improvement potential	An annual rate refurbishment of 3% is European target. Nevertheless, it seems that the effective refurbishment in Europe is not so high.	Update the refurbishment rate with up-to date values	In processing
72.	Task 1 report	1.1.9.5	36	Improvement potential	The energy consumption in the table does not correspond to the data provided by the document “EU energy trend” used as reference. The energy consumption for electricity is	Provide explanation on where this 25 182 PJ comes from.	In processing

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					around 10 000PJ and not 25 182PJ for		
73.	Task 1 report	1.1.9.5	36	Improvement potential	Any energy savings calculation should also take into account the additional energy consumption to produce the higher cross-section cables as well as additional energy consumption for equipments, installation and infrastructure. It should also take into account the additional resources needed.	Provide a life cycle approach taking into account all life cycle phases and other environmental indicators such as resource depletion.	This will be done in later tasks. This is a first screening on energy loss in the cable.
74.	Task 1 report	1.1.9.5	38	Improvement potential	On a technical point of view, the feasibility and consequences on the installation and on the buildings to upgrade to a section S+2 or S+3 has to be checked. First feedbacks from expert is that it is not possible (lack of space for instance in building conduits).	Evaluated with installers on the feasibility to upgrade from S to S+2 or S+3.	Feasibility is not investigated in the first screening. In following tasks this will be taken into account. For instance in tasks 3 the barriers are mentioned.
75.	Task 1 report	1.1.9.5	38	Improvement potential	Similar calculation could be done on resource depletion by using table 1-28. By only considering copper, upgrading from S to S+x would respectively increase the resource consumption of, in average : +39% for S+1 + 95% for S+2 +179% for S+3	Provide a Life Cycle approach taking into account other environmental indicator such as Resource depletion in the calculations, to avoid burdens shifting between life cycle steps or medias.	This will be done in later tasks. This is a first screening on energy loss in the cable.
76.	Task 1 report	1.1.9.7		Conclusion from the first screening	The mentioned saving potential are “brutto” calculations not considering negative impacts for producing and installing bigger cables	Make a note that this potential savings do not yet include any adverse effect for producing and installing bigger cables.	This will be taken into account in later tasks. This is a first screening on energy loss in power cable.

77.	Task 1 report	1.1.1.1.9	51	Table 1-17	The designation code provided for France is not correct. The H07 RN-F is NOT a single core PVC insulated cable with a solid copper conductor. Such product designation in France is H07-V-U	Check the designation code provided in the table. Complete the table as there are many more code designations existing	Accepted Formulated more in general.
78.	Task 1 report	1.1.1.1.9	51	Table 1-17	Table is not complete and correct.	Table should be deleted .	Accepted Table removed
79.	Task 1 report	1.1.1.1.9	51	Table 1-17	Sweden is missing in table.	Add: Sweden SS 4240231-3	Table removed
80.	Task 1 report	1.2.1.3	54	New standards	Should also be mentioned - the 60364-8-1 on “ Low voltage electrical installations - Energy Efficiency “ - The XPC 08-100 on Environmental declaration for EE and HVAC-R products in buildings	Add the 60364-8-1 and XPC08-100 reference	Accepted Added

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81.	Task 1 report	1.3.1.1	55	Legislation	Should be added in the list of factors "Installation mode"		Accepted Added
82.	Task 1 report	1.3.1.1	56	Legislation	"Cable manufacturers adhere to the European RoHS and recycle everything from copper to plastics".	Where this sentence comes from (source). Would be more appropriate to mention "participate to recycling for copper and plastics". All power cables are not submitted to RoHS. It depends on the rated voltage of the cable and its final application.	Will be changed, see recycling in task 3 Note: recycling is mentioned in WEEE
83.	Task 1 report	1.3.1.1	56	Legislation	Building cable comes in Low smoke, fire safety version....	This sentence has nothing to do with RoHS, as well as the sentence on EMI.	Accepted Deleted
84.	Task 1 report	1.3.1.1.	56	Legislation	REACh could also be added in the list of legislation applicable to cables.		Accepted Added
85.	Task 1 report	1.3.1.2	57	Legislation	The decree in France on environmental declaration of construction products and electric, electronic and HVAC-R products should be added in this section. The Norwegian legislation on recycling and treatment of Waste has a dedicated section for cables (Amendment 1 on Product groups for EE-products and EE-waste – § 12 on cables and wires)	Add French decree (2013-1264) and Norwegian legislation (FOR-2004-06-01-930).	Accepted Added
86.	Task 1 report	1.3.1.2	57	Table 1-18	Sweden is missing in table	Add: Sweden ELSÄK-FS	Accepted Added

87.	Task 1 report	1.3.1.4	58	Voluntary initiatives	Could be added in this part : - The PEP association to provide environmental impact of EE and HVAC-R products during their whole life cycle - The tools provided by cables manufacturers to calculate the economic optimum section based on the use conditions		Accepted Added

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88.	Task 1 report	Annex 1-B	68	Table 1-20; 1-21; 1-22	The losses are calculated for all section with current rating between 0.5 to 100A. A cable is defined by its maximum intensity above which the temperature of the conductor will be too high and will induce safety issues for the consumers. Calculation should be limited to the maximum intensity allowable for each section.	Modify the table taking into account maximum intensity for each section.	Accepted. Tables are adapted.
89.	Task 1 report	Annex 1-B	71	Table 1-23, 1-24 , 1-26 and 1-24	Similar tables should be also provided on the increase energy and resource consumption to manufacture S+1, S+2 and S+3 cables.	Increased cross-section will negatively impact resource consumption and manufacturing phase. A life cycle approach is necessary to avoid pollution transfer between medias or life phases and to precisely define in which conditions higher cross- section are better on an environmental point of view.	Noted Will be handled in task 5/6
90.	Task 1 report	Annex 1-B	77	Reducing total length of cable circuit	The part 6.3 (Determination of the transformers and switchboards location with the barycentre 336 method.) of IEC 60364-8-1 specifies the method to use to optimize an installation.		Accepted Barycentre method of IEC 60364-8-1 added

91.	Task 1 report	Annex 1-B	77	Reducing the load per circuit	Reducing the load per circuit is feasible, especially in vertical cables used to distribute the intensity. By multiplying the number of cables, intensity per section is reduced and the temperature dissipation improved. It is then possible to replace a section X by 2 conductors with less than X/2 sections. In some case, this could improve both energy and resource indicators. Still it has to be counter balanced by the larger size of the system which is not always technically feasible in buildings.		Noted
92.	Task 2 Report	all	All	source	Date and sources are not always transparent.	Systematically refer to the date and the exact source of the data (web, paper, organization ...)	TBD
93.	Task 2 Report	all	All		Norway : Market figures cannot be given due to only two main manufacturers in Norway and following competition legislation.		Norway is not a EU28 member

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94.	Task 2 Report	2.1	9-10	PRODCOM Data	Is the scope of products really relevant ?	Do not use the info from the PRODCOM database	In MEErP (p42) is stated :" As mentioned by many stakeholders, Eurostat data for these particular items are usually not very reliable for the analysis of individual products, but they do represent the official source for EU policy and as such are a valuable to the policy makers." The figures found in the PRODCOM category will be used to verify data from other sources (reality check). The note on page 10 will updated accordingly.

95.	Task 2 Report	2.1.2	10	PRODCOM Data	Does it also include transportation cables (cars, train, plane, ship) as well as other LV cables for industry and infrastructure applications?		NACE code "27321380" is defined in PRODCOM as " Other electric conductors, for a voltage <= 1000 V, not fitted with connectors". No exclusions are mentioned, so all mentioned cables in the comment are part of it, as indicated by "others" in the note on page 10.
96.	Task 2 Report	2.2.1.3	12	CRU Wire and Cable Source	We do not consider that this source is a relevant and reliable source to know the Building market, because the product scope is too wide and do not strictly correspond to cables inside a building. **"LV energy**" category includes cables for buildings, but also LV cables for industry and OEM application, meaning automotive, rolling stock … It also includes 1 kV power cables . As an ex, there are 3 to 5 km of cables inside one car, so it really impacts the figures that CRU can show.	Do not use this source of info.	This source is only used to check other sources (upper limit). Extra note is added.

97.	Task 2 Report	2.2.2.2	13-15	Building Stock	We do not agree with the figures and ratios given in this section, mainly because of the period taken into account. The 2005-2010 period is considered , which was a booming period on the building market. The crisis started in 2008, with a deeper effect starting in 2009-2010. **So it is not relevant to calculate market growth hypothesis based on the analysis of data before 2010.**	Use the data of EUROCONSTRUCT and EUROSTAT instead. They are reliable source of information The scope of EUROCONSTRUCT does not completely includes the EU 27 countries but we consider it as relevant and reliable. It consolidates reliable data from 17 EU countries + Norway + Switzerland (which are not strictly speaking into the EU 27) We consider that the 10 countries not taken into account do not change so much the trends of the market. Out of the scope countries are Bulgarie, Chypre, Grèce, Malte, Roumanie, Slovénie, Lettonie, Lituanie, Estonie, Luxembourg.	Please provide report (or relevant section) Note: and the permission to use it in a public study

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
98.	Task 2 Report	2.2.2.3	15-16	Power Cable stock	We do not know how the ratio of 25% has been calculated so we cannot agree	Be more transparent on the calculation formula	Reference added
99.	Task 2 Report	2.2.2.4	17-18	Distribution of power cables based upon cross sectional area	The input of installers is necessary here. The source of data mentioned here is not enough	Meet installers and design offices to get more info about cable installed in buildings	New enquiry will be discussed in the next stakeholder meeting
100.	Task 2 Report	2.2.3	18	New Sales growth rate	We do not agree with the figures given in this section They are based on the 2005-2010 period, which is not representative of the current market situation and in the next few years	Check Euroconstruct report published in 2013	Please provide report (or relevant section) Note: and the permission to use it in a public study
101.	Task 2 Report	2.2.4	18-19	Replacement sales growth rate	We do not agree with the figures given in this section They are based on the 2005-2010 period, which is not representative of the current market situation and in the next few years	Check Euroconstruct report published in 2013	Please provide an extract with relevant data.. Note: and the permission to use it in a public study
102.	Task 2 Report	2.2.4	18-19	Conclusion	We do not agree on the assumptions taken. The ratio for cable replacement during renovation, based on the case in Germany, cannot be applied for all Europe	Check with installers and national building authorities, in charge of the control of the installations.	Please provide more data on cable replacement during renovation. New enquiry will be discussed in the next stakeholder meeting
103.	Task 2 Report	2.2.5	20	Market and stock data summary	Data not accurate	Review according to the previous comments	

104.	Task 2 Report	2.4	21	Consumer expenditure base data	We do not agree with the methodologies used to calculate "purchase prices" and costs. They are too " simple" and not accurate.	The right assumption for price could be: Cable price = K1 *copper price + K2 (K1 and K2 = 2 constants). K2 to reflect the plastics, labor cost and other added values.	Added formula and footnote to indicate the origin of the purchase price. Please provide the data if you can't agree with this figure.

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
105.	Task 2 Report	2.4.1	21	Purchase price	The definition of the consumer is unclear: is it the end- customer ? the installer ? the wholesaler ? Which “purchase price” do we talk about ?	Clear definition	Added footnote.
106.	Task 2 Report	2.4.5	22	Disposal costs / benefits	How the ration of 70% has been defined ?	More transparency on the way ratios are calculated. There are official companies today who takes back the cable scraps. They could be a good source of info.	In processing
107.	Task 3 Report				Norway comment : Installation friendliness of cables and effective/smart packaging is key for the el-installers. In addition to the el-installers, consultants may specify the type of cables to be used, especially for official buildings. Also that cables should be possible to install, repair and maintenance during a long, cold winter period, i.e. the protective polymer layers should not crack at low temperatures		Will be added
108.	Task 3 Report	3.1.2.2	14	Cross- sectional area	The selection of the CSA is first done considering the intensity that need to be transported	Add in the list: their maximum admissible intensity.	In processing
109.	Task 3 Report	3.1.2.2	14	CSA	In installation conditions should be also included the installation type		Agree. Is added.

110.	Task 3 Report	3.1.2.2	14	Table 3.2	Values to be checked by installers, in particular the min ones.		New survey towards installers and engineering companies?
111.	Task 3 Report	3.1.2.5	16	Conclusion	First feedback is that skin effect is relevant in buildings. In that case, it may be interesting to use 2 cables with reduced cross section instead of 1 with large CSA		Added extra consideration in the conclusion.
112.	Task 3 report	3.1.4.5	16	Table 3.4	How has the correction factor for lighting circuit been determined?	Clarify the calculation for the correction factor of lighting circuit.	Correction factor is removed.

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
113.	Task 3 Report	3.1.4.5	22	Conclusion	Assuming that dedicated and distribution circuit have the same length is strange. Question should be asked to installers having filled the questionnaire why they did not provide information on distribution circuit. There should be a reason	Provider the report on installers feedback. Clarify the distribution circuit length with installers and why no answer has been provided.	Only aggregated values can be released (privacy statement) which in fact is table 3-5 . The question regarding the length of a distribution circuit was not asked at that time. It will be asked in a new survey.
114.	Task 3 Report	3.1.4.8	23	Table 3-6	Values have to be validated by installers stakeholders.	Validate Table 3-6 with installers stakeholders.	These are the results of the installers inquiry, except for the lengths on the distribution circuits. The organization AIE representing the installers is one of the stakeholders in the study and has received the report. In a new survey (TBD), installers can validate this data.

115.	Task 3 Report	3.1.4.6	24	Table 3-7	In Annex B, the load branch length depends on the number of branches (varies between 0.2m and 1m). Could you explain why? It should be constant and represent the effective load branch length in a circuit, information to be provided by installers? Moreover, how is the load branch factor selected to 10%? This assumption may have a high impact. For instance, considering that all the length of cables between nodes are equal, the kd factor will change from 0.4 to 0.24 for 6 branches for instance.	Justify calculation of kd factor and validate the assumptions with installers.	Average branch length was not asked in the inquiry. Added extra tables in Annex B load branch factor corresponding with a load branch of 50% , 100% and 200% factor to illustrate the effect of this factor. Will be included in the new survey for validation.
116.	Task 3 Report	3.1.4.6	24	Table 3-8	Units in the table are in (m). If a number of nodes, there should be no unit	Clarify the unit in the table.	Accepted. Unit is removed in the table.
117.	Task 3 Report	3.1.4.6	25	Table 3-9	The values proposed in the table do not correspond to the aggregation between table 3-7 and table 3-8. For instance in residential, average number of socket given is 10.3, which should lead in table 3-9 of a kd factor avg of less than 0.38. The value provided in table 3-9 is 0.5	Clarify the values provided in table 3-9 and their calculation method.	Agree, table is adapted.

118.	Task 3 Report	3.1.4.7	25	Rated diversity factor	To be confirmed. Example?		The load factor and load form factor are specified at the level of the circuit load. So no diversity factor is needed.
119.	Task 3 Report	3.1.4.9	26	Installation method	The method of installation has an impact on the max admissible intensity in the cable. In the formula 3.2 and 3.5 it will then impact the I and not the r or the section.	Modify the sentence.	Sentence changed.
120.	Task 3 Report	3.1.4.10	27	Single or three phase system	The purpose of this chapter is not clear. What is the conclusion?	Clarify this chapter.	For clarification: one can have a 3-phase connection to the distribution board and only use single phase circuits.

	Document comment	Section in document	Page number	Topic	Comment	Proposed change	VITO
121.	Task 3 Report	3.1.4.11	27	Distribution levels	In Page 29 of task 1, it is mentioned that single family houses have generally one circuit level. For residential application, the ratio of single family houses and multi-dwelling buildings should be taken into account to calculate the percentage of distribution level to be considered, and to apply if necessary a correction factor in the calculation. In MEErP Part 2, values provided are 54% of one/two family dwellings and 46% multifamily dwellings.	For residential, take into account this ratio of houses with or without distribution level. Otherwise, distribution losses estimation for residential will be doubled.	Added
122.	Task 3 Report	3.1.4.12	27	Rate diversity factor	To be validated by installers. Is it a coefficient used to design the installation (and thus would be a max diversity factor for safety) or is it the effective one that could be "measured" in a building?		Conclusion has been adapted, because this factor will not be used in Task 4 till 7. See also 3.1.4.7.
123.	Task 3 Report	3.1.5.1	28	Load factor	All assumptions should be carefully looked at. For instance, considering the office lighting, and using the data from MEERP part 2 (p177), considering offices and conference rooms surfaces, the load factor will be 0.82*2061+0.18*650 = 1806 = 20%. Modification in assumptions may have a great impact on the energy savings calculation	Use as much as possible assumptions from MEErP methodology when available.	The sensisivity will take care of this issue. MEErP part 2 will be looked at. Note: This data is for ventilation systems, not for lighting (different operating hours)
124.	Task 3 Report	3.1.5.1	28	Load factor	How is the load form factor of 1.96 calculated?	Clarify the calculations	Added formula

125.	Task 3 Report	3.1.5.1	30	Table 3-11, 3-12 and 3-13	Please provide information on assumptions (source) and calculation method done for all the data, as well as units when applicable.	Detail assumptions and calculated methods used to complete the table.	Only Kf, αc and their product are calculated. Formulas are mentioned on page 28 and 29. All other fields are assumptions.
126.	Task 3 Report	3.2.1	36	Space heating	Agree on the yellow comment.		Noted
127.	Task 3 Report	3.3	37	End of Life	Actual text • Present fractions to recycling, re-use and disposal for copper:95%?, 0%, 5%? • Present fractions to recycling, re-use and disposal for aluminium:95%?, 0%, 5%? • Present fractions to recycling, re-use and disposal for insulation:50%?, 0%, 50%?	Assumptions proposal : • recycling rate of copper and aluminium of reclaimed and recycled cables close to 95% • recycling rate of the reclaimed insulation: unpredicatble. May completely change depending on: ✓ the kind of materials (rubber poorly	Text has been changed. Defaults of EcoReport tool are used, except for re-use.

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
					• Present fraction of second hand use and refurbishment: 0% • Product use & stock life: 40 years? • Repair & maintenance practice: not existing • Collection rate: 95 %? • Second hand use: not existing Agree on 40 years lifetime and 0% for second-hand use. No information on other assumptions	recyclable, plastic is better recyclable) the possibility to separate the plastics from the rest of the cable (which may depend on the cable design and plastics mix) Present fraction of second hand use and refurbishment: 0% Product use & stock life: 40 years Repair & maintenance practice: o at the end of life, not repaired. o During life, repair possible for big cross sections after accidental damage. Collection rate: No data available. Will be different country by country. Second hand use: not existing	

128.	Task 3 Report	3.4.1.3	37	Refurbishment	Financial incentives for wall insulation or new window have no stimulation effect on electrical installation renewal. Only financial incentives could push for such renovation.	Review or remove this chapter	Reformulated.
129.	Task 3 Report	3.4.2.1	38	Existing installation	Two additional barrier could be added in this chapter : - The higher cable volume that could avoid any possible renewal due to lack of space (already mentioned in 3.4.2.3). - Moreover, apart from the space, use of higher cross-section will induce a non negligible cost increase of the installation due to building infrastructure. - Finally, any modification of cables size will require a modification of the other equipments such as socket-outlet and other accessories in the electrical installation	Review this chapter with other negative impact on the installation	Added.

	Document comment relates to	Section in document	Page number	Topic	Comment	Proposed change	VITO
130.	Task 3 Report	3.4.2	38	Barriers	Should also be mentioned as a barrier the additional cost of S+x cables related to : - Cable manufacturing cost - Cable transportation cost - Cable installation cost if more time is needed - Electrical system increased cost.		Added
131.	Task 3 Report	3.4.2.2	39	Material use	How are the 1.2 to 9.7 million tons over 15 years calculated?	Provide the detailed calculation	Total paragraph has been deleted, because consequences of design options will be calculated in Task 6.
132.	Task 3 Report	3.4.2.2	39	Material use	It is mentioned “in 2009, recycled copper met 45.7% of Europe’s demand”; Is this information used to calculate the million tonnes extra per year? If yes, it should not be used. The use of recycled copper in electrical cables is limited due to its negative effect on copper resistance, and increased losses	Detail the calculation method used.	The factor was not used in the calculation. Sentence is removed.

133.	Task 3 Report	3.4.2.2	39	Material use	As calculation has been done for volume increase of copper, a similar table as table 3-16 should be provided for insulation volume increase. A S+1 strategy lead to a mean increase of +40% insulation volume increase. A S+2 strategy lead to a mean increase of +95% insulation volume increase	Provide volume and cost increase for the proposed (S+1 and S+2) proposed strategy for both copper and insulation.	The assumption that the outer radius increases with the same factor as the inner radius of the insulation cylinder for a s+x strategy is not correct. Total paragraph and annex A has been deleted, because consequences of design options will be calculated in Task 6.
134.	Task 3 Report	3.4.2.3	40	Handling and space requirements	As already mentioned, higher cross-section cable will have a high impact on building design and cost due to the need for more space.	Add the impact of the higher cross-section on the building design and cost.	Cost implications is added.
135.	Task 3 Report	3.4.4	41	Physical environment	Ducts and tubing is not mentioned specific	Add: Thicker cables need larger ducts and tubing, which drives the costs	Added

ANNEX G COMMENTS AND RESPONSES ON TASK 1 – 3 (VERSION 2) AND ON TASK 4 AND 5 (VERSION 1)

Organisation: ECI	**Name: Fernando Nuño – Fernando.nuno@copperalliance.es**	**Date: 12th June 2014**

Ref.	**Section -**	**Page**	**Topic**	**Comment**	**Proposed change**	**VITO reply**
1	Task 2 - 2.3.1	25	Market production structures	Information on copper mines and copper production in Europe is not accurate.	It was already suggested in the previous ECI's comments (4 December 2013) to use http://www.copperalliance.eu/industry/economy as information source.	Paragraph has been changed accordingly.
Recommendation. 2	Task 2 – 2.4.1	26-27	Purchase price	**Original quote** *"Copper is becoming a scarce resource and an increased demand caused by the use of wires with an increased cross-sectional area may result in even higher market prices."* Copper is a commodity traded on the LME, which fixes its price; trying to forecast price is not appropriate, especially considering the marginal contribution of a potential regulation in this field compared to the annual copper volume traded. As for copper scarcity, please note that according to USGS data, since 1950 there has always been, on average, 40 years of copper reserves and over 200 years of resources left. - See more at: http://copperalliance.org/core-	It was already suggested in the previous ECI's comments (4 December 2013) to modify this sentence, deleting any consideration of copper as a scarce resource and deleting any tentative forecast on commodity prices.	Agreed. The paragraph has been changed accordingly. Reference is also made to the European listed critical raw material list which does indeed not include Copper.

Ref.	Section	Page	Topic	Comment	Proposed change	VITO reply
				initiatives/sd/economy/long-term-availability-of-copper/ http://copperalliance.org/wordpress/wp-content/uploads/2014/04/ica-long-term-availability-1404-A4-low-res.pdf Finally, it should be considered the high recyclability ratio of copper, especially from used cables. Find more at http://copperalliance.org/core-initiatives/sd/environment/recycling/. According to the International Copper Study Group (ICSG), 41.5% of the copper used in Europe comes from recycling. http://copperalliance.eu/about-copper/recycling A comprehensive study of the stocks, flows and recycling rates for copper has been developed by the Fraunhofer Institute. This complex, three-year study has resulted in an improved understanding of how copper is used and re-used by society: http://pubs.acs.org/doi/ipdf/10.1021/es400069b http://copperalliance.org/core-initiatives/sd/stocks-flows/ Finally, please note the following statement on copper availability: http://copperalliance.org/core-initiatives/sd/availability/		

Ref.	Section	Page	Topic	Comment	Proposed change	VITO reply
3	Task 2 – 2.4.1	26-27	Purchase price	The price of cable has a key impact on the results of the study. The only source of information has been web shops. Web shops with public prices do not correspond to the reality of real prices applicable for the tertiary and industrial sector installations. Web shops are B2C business, while tertiary and industrial installations are B2B (whose prices are not published). Under the current assumptions, the ratio between the average cost of cable (0.075 €/mm2/m/core) and cost of copper (0.047 €/mm2/m/core) is 1,6. Egemin study (2011) considered cable prices based on real quotations for the tertiary and industrial sector. The ratio between the cost of cable and cost of copper was 1,25 (much lower). Also, checking Prodcom average price for cables leads to 0.047 €/mm2/m, very far from the 0.075 from web shops (especially under current copper prices, significantly lower than in the past years).	Price of cable has to reflect B2B sector. It could potentially be assessed through anonymous surveys with engineering and EPC companies dealing with procurement of cables for its installation in the tertiary and industrial sector. Consider as well average values from statistics (prodCOM for instance) as a crosscheck. Discard publicly available prices on the web, which are not representative of the real behavior of the market for the tertiary and industrial sectors.	Paragraph has been changed according the study "LV power cable market prices" of ECD.
4	Task 3, Table 3-1	14	Conductor material electrical resistance	First line says "Electrical Resistivity (relative)", while it should say "Electrical Conductivity (relative)	Make correction	Sentence has been changed.
5	Task 3, Table 3-4	22	Circuit length	Egemin study considered for small and large offices average lengths significantly longer (50 meters as an average, >> 31 meters).	Check with engineering companies through anonymous survey the typical lengths, so as to assess the results of the questionnaire.	Table is based upon questionnaire results, (these results included the Egemin

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
				Also average length in industry considered by Egemin study was 80 meters >> 47 meters)	Split into several base cases and define a typical installation, considering lengths based on questionnaire + experience from engineering companies.	responses). Additional responses to the 2nd survey have been incorporated.
6	Task 3, 3.4.2.2	42	Implication on material use	"slight increase in material price"	See the comment ref. 2	Sentence has been changed.
7	Task 5, Table 5-6	14	LCC input parameter per base case	These parameters are to be fixed either for a given year or for a future scenario. In case of working for a given year, the most recent the better (2013 would be the best). Electricity prices could be adapted to each sector (tertiary, industry), if such information exists. The price should be final (including taxes), so as reflecting the real savings in case of lower electricity consumption. Information source should be public and widely accepted (Eurostat for instance). While investment is made in year 1, electricity savings take place along the 14 next years. During this time, electricity price will increase. Should the study consider an average price between the present and the next 14 years? Product price is to be further assessed, as previously indicated in comment #3. The initial prices considered seem too high compared to ProdCOM or to previous analysis (Egemin study)	Address all these aspects.	The electricity price is according the MEErP guideline. It differentiates between residential and non-residential sectors. 2010 is used as reference year. All prices in the non-residential sector in the study are without taxes. This will be mentioned in Task 2. In the Task 5 report, only the relevant parameters for input are mentioned. The EcoReport tool has a lot of other default parameters, as mentioned in the MEErP guideline. One of them is the escalation rate of 4% for running costs, as

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
						mentioned in Task 2. The price has been adapted accordingly.
8	Task 5, Table 5-18	27	Cross-checks	The energy flowing through the distribution system has also to flow somewhere afterwards. In case of industry, dedicated circuits are allocated only with 85% of the current, so the remaining 15% has to be also considered in any kind of circuit. Idem for services, 100% of current flowing through the distribution system is allocated to lighting (10%), dedicated circuits (85%), but still misses the 5% left.	Consider 100 % of current flowing through distribution system, then 100% flowing through any kind of circuits (making sure to totalize 100% again).	Exra base cases are added. The current flows 100% through the distribution circuits and then this current is distributed over the other circuits (sum is 100%)
9	Task 5, 5.6	27	Cross-checks	The analysis as per the current version shows that parameters are still to be adjusted. It is necessary a classification of the nature of parameters, so as to know what are factual data, what are hypothesis based on previous reports or questionnaires and what are abstractions for simulation purposes. Factual data should be used as reliable input, not subject to sensitivity analysis, as these are facts. Such data should be verified in any case. Reports and questionnaires offer a range of values plausible. Hypothesis based on such sources of information are to be submitted to a robust sensitivity analysis. Abstractions are not intended to represent the reality, as these are just intermediate steps in a calculation leading to the	Classify the inputs according to the following categories: • Facts – punctual values (i.e. electricity consumption in Europe) • Facts – range of values (sales of cable) • Hypothesis based on feedback from questionnaires, usually leading to low, average and high values (length and cross section of typical circuits, potentially price of conductors) • Hypothesis based on literature (building stock, renovation rates, average lifespan) • Hypothesis based on observation or expected behaviour (load	This advice will be taken into account. In the sensitivity analysis in Task 6 en 7 the parameters will be challenged against their low and high values.

<table>
<tr><th>Ref.</th><th>Section</th><th>Page</th><th>Topic</th><th>Comment</th><th>Proposed change</th><th>VITO reply</th></tr>
<tr><td></td><td></td><td></td><td></td><td>researched results.</td><td>factors).
• Abstractions (stock based on base cases).

Depending on the category of the inputs, a different treatment should be done (consider sensitivity analysis, determine max and min values, etc.).

The model should give priority to the most robust parameters first (such data will always be valid).</td><td></td></tr>
<tr><td>10</td><td>Task 1, 1.3.1.4</td><td>65</td><td>Voluntary initiatives</td><td>A number of software tools exist for the design of electrical installations, some of them offering the possibility to run energy efficiency calculations and potential optimization.</td><td>Consider mentioning the following:
<table>
<tr><th>Software</th><th>Manufacturer</th><th>Economic sizing
Standard</th><th>Optional</th><th>External</th><th>Remarks</th></tr>
<tr><td>Caneco BT</td><td>ALPI Software</td><td>No</td><td>Partly Investment estimation only</td><td>Yes, through export and import to and from external processing (proven)</td><td>Modular software, features depend on actual licensed configuration</td></tr>
<tr><td>TR-ciel (legacy)

Elec Calc</td><td>Trace Software</td><td>No</td><td>Partly Investment estimation only</td><td>No clear information on export and import facilities</td><td>Features depend on installed options (TR-ciel)

Unclear for successor Elec Calc</td></tr>
<tr><td>Kitgoni</td><td>Kitgoni SPRL</td><td>Yes</td><td>/</td><td>/</td><td>The URE module (Utilisation Rationnelle de l'Energie), is standard included, the user only has to choose to use it.</td></tr>
<tr><td>Simaris design</td><td>Siemens</td><td>No</td><td>No</td><td>No</td><td>Import & export facilities can be extend through Simaris project software</td></tr>
<tr><td>Ecodial</td><td>Schneider Electric</td><td>No</td><td>No</td><td>No</td><td></td></tr>
<tr><td>Solutions Electrical</td><td>Solutions Electrical UK</td><td>No</td><td>Partly Investment estimation only</td><td>No</td><td></td></tr>
</table>
</td><td>Table is added.</td></tr>
</table>

Organisation: Europacable	Name: Volker Wendt	Date: June 20th 2014

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	Task 1 – All	All	General	Reference of data used should be improved		
2	Task 1 – All	All	General	Number of lines is still missing. Would it be possible to add the number of lines to improve comprehensiveness of comments?	Add number of lines in the different reports	Ok
3	Task 1 – All	All	General	The title of the top of each page is still “list of acronyms”	Modify the top pages of all documents	Accepted.Text changed.
4	Task 1 – Chapter 1	10	Summary of Task 1	The sentence highlighted in green is not clear. Please clarify the meaning.		Text reformulated and explained in the meeting (see powerpoint)
5	Task 1 – Chapter 1	16	Insulation	Write “vinyl” instead of “Vynil”		Accepted.Text changed.
6	Task 1 – Chapter 1.1.3	21	“fixed wiring”	Both single core and multi-core cables can be installed in buildings.	Remove (single core) in the “fixed wiring” paragraph	Accepted.Text changed.
7	Task 1 – Chapter 1.1.8.1	25	Nominal Cross-sectional area	Reference to US-standards AWG is not needed	Remove sentence on USA and Canada conductor size.	Accepted.Text changed.
8	Task 1 – Chapter 1.1.9	32	General comment to loading in residential buildings	Generally in all buildings more and more energy efficient equipment are used. LED-lights, LED TV-sets and efficient refrigerators are some examples. This gives lower loads and as a consequence lower losses in the existing network.		No review planned, explained in meeting. Text added in bold: ‘These are indicative for a first screening only and will be updated in later chapters’

	Task 1 – Chapter 1.1.9.3.1	34	Market and stock data	Data on sales and stocks of power cables are extracted from the Working Plan, but the source of such information is not publicly available. Such data should be used with caution. It is recommended for the other tasks reports, to use data with transparent and public sources. As an example, in the working study, a coeff 1.5 is used, assuming (industry + services)=1.5*residential. In the Working plan, the reference of such 1.5 is mentioned as "based on copper wire and cable consumption statistics", without reference to any document or report.	Use table 1-4 and 1-5 with cautious in other tasks reports due to lack of transparency on data source.	No review planned, explained in meeting. Text added in bold: 'These are indicative for a first screening only and will be updated in later chapters'
10	Task 1 – Chapter 1.1.9.3.2	35	Table 1-6	Previous comments on the total Energy demand (PJ prim) has not been clarified. "What does the total Energy (PJ prim) stands for? If it corresponds to total EU energy demand, including all fuels, it does not correspond to the value given in the reference document"	Clarify table 1-6	No review planned, explained in meeting. Text added in bold: 'These are indicative for a first screening only and will be updated in later chapters'
11	Task 1 – Chapter 1.1.9.4.1 1.1.9.4.2 1.1.9.4.3 1.1.9.4.4 1.1.9.4.5	37	Table 1-7	Previous comments (N°60 to 72) from Europacable have not been answered.	Please provide more information: - on the calculations of table 1-7 and on assumptions of chapter 1.1.9.4.1 - on the calculations of table 1-8 and on assumptions of chapter 1.1.9.4.2 - on the calculations and on assumptions of chapter 1.1.9.4.3 - on 1.1.9.4.4 and 1.1.9.4.5	No review planned, explained in meeting. Text added in bold: 'These are indicative for a first screening only and will be updated in later chapters'
12	Task 1 – Chapter 1.1.9.7	42	Conclusion	New conclusions on eligibility and scope have been provided in this 2nd draft report whereas comments on the previous chapter (1.1.9.4.1 to 1.1.9.4.5) have not been answered and still "in processing".	Conclude on those chapters after answering the previous comments	Text added in bold: 'These are indicative for a first screening only and will be updated in later chapters'
13	Task 1 – Chapter 1.2.1.1	44	Reference to standards	Reference should be made to the European HD 603 and HD 604 for 1 kV cables.		Added (HD 603 is out of scope)
14	Task 1 – Chapter 1.3.1.2	63	Legislation at member states level	The internet link making reference to the French legislation on environmental product declaration of building products is not correct. It refer to a software supplier.	Change reference www.codde.fr by reference to the French government : http://www.developpement-durable.gouv.fr/-La-declaration-environnementale,7322-.html	Accepted. Text changed.
15	Task 1 – Annex A	67	Table 1-19 Supply parameters	Information of Swedish electrical system is missing	Swedish parameters	The intention of this table is to give differences in supply parameters between some EU countries, not to give a complete overview of all the differences between al the EU countries.

16	Task 2	Prodcom data	Table 2.2 and 2.3	Highlight that those data include both aluminium and copper cables.		Is extra highlighted in the note on this page .
17	Task 2 – Chapter 2.2.2.2.5	16	Table 2-11	Internal transport should be removed from values of table 2-11 (150TWh for 2007)	Remove 150TWh related to internal transportation	Cannot find the source of the 150TWh. Be aware that the table shows consumption of electricity. Electricity use in the transportation sector (trains,…) is 64TWh in 2007. This is lower than internal transport? In Task 7 a remark will be made that these figures may be too high, for the industry, as there are no figures, discriminating between indoor and outdoor consumption , available.

18	Task 2 – Chapter 2.2.2.3	18	Floor space	Depending on data source, information on building % varies a lot.	Please cross-check the area assumptions with other source, to provide calculation on agreed and reliable data.	
19	Task 2 – Chapter 2.2.2.3	18-20	Data source	Many data are from CuIoU survey from European Copper Institute, not found on internet	Please provide the report.	The copper Institute will be asked if the study could be publicly available.
20	Task 2 – Chapter 2.2.4.3	22	Replacement sales rate	The Ecofys study estimates the overall renovation rate for non residential building to 12.4% From BPIE study mentioned previously, the renovation rate is estimated between 0.5 to 2.5% and the tables 3A2 from their study provides renovation rate for non-residential around 1.5 to 2.75, so 12.4 % seems a little high	Please cross-check renovation and construction rate with other data source before calculation.	The section has been adapted.
21	Task 2 – Chapter 2.3.1	26	Aluminium	It is mentioned that “aluminium conductors are not so much used in buildings”. Aluminum conductors can be used in buildings for high cross-section.	Get data from installers or electrical installation designer on the amount of aluminium cables in industry and services buildings.	The installers can’t give detailed info on the amount of Al. cables in buildings, only that it is sometimes used for high cross-section. A base case reflecting a circuit with aluminium cables is added to the study.
22	Task 2 – Chapter 2.4.1	26	Purchase price	“Copper is becoming a scarce resource”. We do agree with this comment, and it seems important for us to highlight it	Reference can be done to the JRC technical report “Integration of resource efficiency and waste management criteria in European product policies – second phase – report N°2 (Report EUR 25667 EN) concluded on that copper contribute relevantly to the majority of the considered impact category.	Comment will be included, although contradicted by ECI.
23	Task 2 – Chapter 2.4.1	27	Product cost	The average value of 5.3€/kg from table 2-3 represent the average value for cables, so it cannot be transposed into an average cable price per mm^2 of copper. The density of copper is not the average density of cables and wires. Moreover, the value of table 2-3 includes both aluminium and copper cables.	Review chapter 2.4.2	Chapter has been reworked with the available information.
24	Task 2 – Chapter 2.4.1	27	Product cost	In table 2.22, again the price of 535€/100kg is the price of cable and 100kg of cable is not 100kg of copper.	Check the calculation based on cable and copper price and weight.	Text has been reworked.
25	Task 2 – Chapter 2.4.1	30	Installation costs	Reference 33 not found in intranet.	Please provide the report.	Publication is released by the copper institute
26	Task 3 – Chapter 3.1.2.2	14	CSA	The selection of CSA is first done considering the intensity that needs to be transported	Add in the list : their maximum admissible intensity	Added
27	Task 3 – Chapter 3.1.4.6	24	Table 3-6	There is 2 values in the different cells. What does the lower value represents	Clarify the values given in the table.	Format problem.It was just one value. Table is split up.

28	Task 3 – Chapter 3.1.4.6	26	Table 3-7	Previous comment N° 117 from Europacable has not been applied	Remove (m) from table 3-7 as it represent a number of nodes and not a length	Text has been changed.

29	Task 3 – Chapter 3.1.4.6	27	Table 3-8	Values from table 8 have been modified. Please clarify the assumptions used on: - number of nodes (min, max, avg) considered for each circuit - Load branch length factor for each circuit.	Provide assumptions used and confirm with electrical installation designers and installers.	Text has been enhanced. The values in first version were modified because they were educated guesses. In the second version they are based upon results (number of nodes) of the installers questionnaire and calculations made and shown in table 3-6.
30	Task 3 – Chapter 3.1.4.7	27	Rated diversity factor	To be confirmed. Example?		The load factor and load form factor are defined at the circuit level, not per appliance connected to the circuit. A rated diversity factor is necessary if one has a load and load form factor per appliance..
31	Task 3 – Chapter 3.3	39	End of Life	Reference to table 3-14 is not correct	Modify 3-14 by 3-16	Modified.
32	Task 3 – Chapter 3-3	40	Table 3-15	The use of formula 3.8 is does not take into account the demolition rate. Moreover an average life of 170 years for residential building is impossible as no electricity was provided in houses 170 years ago.	Provide new life time parameters for cables .	New lifetime parameters are introduced , based upon comments from stakeholders. Demolition rate is taken into account.
33	Task 4 t –	13	Chapter	There is a chapter 4.2.2.1 but no chapter 4.2.2.2	Rename the titles number	Title has been removed.
34	Task 4 – Chapter 4.2.2.1	18	Table 4-5	The max cable length in table 4.5 (1952) does not correspond to a cable diameter of 6.05mm. It corresponds to a cable diameter of 12.	Check the values in the tablei	Extra information is added in table to explain. A 3x2.5mm2 example is used now.
35	Task 5 – Chapter 5.1.1	8	Table 5-1	How has the load current been chosen for each circuit?		The circuits are 100% loaded. For each circuit the required CSA according to IEC 60364-5-52 is determined and checked with a commercial calculation tool.
36	Task 5 – Chapter 5.1.2	11	Table 5-2	Be careful in the BoM that : - XLPE is NOT HDPE - PVC in the tool is probably rigid PVC. PVC used for cables is based on fillers and plasticiser, which may be in proportion higher than PVC content. - If filler considered as PVC, same remarks apply for filler.		XLPE is now marked as LDPE in the EcoReport tool. No information on filler material is provided by the cable manufacturers. PVC is now marked as PVC (and not as ecyclable PVC) in the EcoReport tool, as suggested in the 2nd stakeholder meeting. . Composition has been altered based upon info from cable manufacturers.

37	Task 5 – Chapter 5.1.2	11	BoM	Copper is taken out of the ground and is considered a scarce material. Copper should consequently be used as little as possible	Consider negative impact on resource depletion of any increase of copper consumption	Negative impact on resource completion is not part of task 5. It will be discussed in task 7.
38	Task 5 – Chapter 5.1.3	13	Table 5-5	How has the length of the circuit been decided, in particular : - Service lightning, which is 31.4 in table 3-4 but 38m used in table 5-5 - Service distribution and Industry – distribution, which have not been answered by installers, according to table 3-4		Table has been adapted and uses correct values from table 3-4. Values for distribution circuit are added according 2nd installers questionnaire.
39	Task 5 – Chapter 5.2	14	Table 5-7	There is some issues is the unit	For materials, replace g/m per g/circuit.	Text has been changed.
40	Task 5 – Chapter 5.2	14	Environmental impact	Considering the issue on resource efficiency with copper, highlighted by Europe, it would be recommended to calculate the “Resource depletion” indicator, following the ILCD recommendation.	Add resource depletion indicator in environmental analysis.	This chapter looks at base cases, and not at design options or scenarios. This will be considered in Task7.
41	Task 5 – Chapter 5.3	24	Cost for consumer	A higher cross-section will raise the building costs due to more expensive cables, longer installation times, more expensive ducts/tubing/ladders and accessories (connections, switches, etc). All efforts are made to lower building costs	Consider negative impact on cable building by increasing copper cross-section.	This chapter looks at base cases, and not at design options or scenarios. This will be considered in Task7.
42	Task 5 – Chapter 5.5.1	25	Table 5-15	The EU electrical installation cannot be summarized by 5 base cases.	Check consistency and real scenarios with installers and el installation designer for representativity of base case for EU.	9 base cases are now used to better reflect the European context. Installers and engineering companies are consulted by means of 2 questionnaires.

Organisation: EDF	Name: Franchet Maud	Date: 04/06/2014

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	4.2.1	10	production	The study should also consider the problem of energy product resources and the risk of shortage.		Task 3 3.4.2.2 eludes the implication on material use. The impact on resources will be considered in Task 6 and 7 because they are related to the design options and scenarios.
2	4.2.2	13	distribution	The way cables are transported (train, truck, plain, boat) and the distance from the manufacturing plant to the installation place should be integrated in the analysis.	Include greenhouse gas emission due to transport in the environmental analysis and in the economic analysis.	The MEErP EcoReport tool is used to calculate the environmental and corresponding economic impact. See Greenhouse gasses at distribution level in Task 4.
3	4.2.4	19	Improvement option	The 2S scenario can be difficult to apply. Indeed, in order to double the number of cables, more space is needed. This is not always the case.		Indeed, this is mentioned as potential barriers in task 3 section 3.4.2.1 and 3.4.2.3.
4	3.1.5		Parameters related to the building and the loading	I don't agree on the use of an average value of the load factor for all kinds of industry and services. Average values are quite sensitive to outliers data and may not be relevant.	Use values of the load factor that are specific to sector and the use of the cable (ex : one value for the lighting cables of a power plant and another one for the emergency cables of a power plant)	Agreed that there is a big spreading and uncertainty about the average. This will be solved by a sensitivity analysis in Task 6.
5				I'm aware that collecting data is not an easy task, however the fact that most of the data comes from the Copper Institute can raise the problem of the objectivity of the study, in light of a potential conflict of interest.		All stakeholders are invited to provide as much data as possible. The study budget is limited and is therefore primarily based upon results of other studies. 2 surveys are sent during the study to installers and cable manufacturers to collect more information.

6	3.3	39	End of life behaviour	What about the integration of recyclability of the used cables? Some insulator materials are not recyclable XLPE vs HDPE etc ... in particular in light that ECI claims that according to "the International Copper Study. Group (ICSG) 41.5% of the copper used in Europe comes from recylig "		More info is included in the OVAM study to which a reference will be added.. XLPE is now marked as LDPE (non-recyclable) in the EcoReport tool. PVC is marked as non-recuclable.
7	3.3	39	End of life behaviour	Why mentioning only PVC? Other kind of islations such as XLPE can be used.		See previous comment
8	1.1.3	21	First proposed scope of this study	Could it be possible to consider production power plants as “process installations”, which are out of the scope as stated in the remark ?		To be discussed and reviewed in Task 7, they are not in the objective objective of intermediate tasks 3-6
9	1.1.3	21-22	First proposed scope of this study	In the paragraph “out of the scope” is it possible to change the point 7 and make it more precise?	“Cables used for all types of power plants”	Text updated ‘Cables used for power plants such as PV, Wind, ….;’ Note: To be discussed and reviewed in Task 7.
10	1.1.9.7	41	Conclusion from the first screening	In the paragraph, “There is significant potential for improvement.”, how could you justify 45% penetration strategy of S+2 by 2030 ?		This is a first screening and the 45% is an assumption for a scenario. Potential scenarios are worked out in Task7.
11	1.1.8.2	28	Secondary product performance parameter related to the use of the cable	Why having chosen a power factor of 0.8? Is it always the right value, especially for lightning?		This bullet point is explaining the formula listed in IEC 60364-5-52 © IEC:2009. The explanation of the parameters is extracted from this standard. Potentially tariff structures are based on this limitsand end users work therefore to this value.

Organisation: Nexans Norway	Name: Ivar Granheim	Date:

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	All tasks	All	General	Data, such as cables length installed in buildings or sales or stocks of power cables will have a great impact on the final conclusion; The reliability of such data needs to be checked and validated among stakeholders before conclusion on losses in cables and energy efficiency potential can be done.		Stakeholders are always welcome to provide additional data.
2	All tasks	All	General	The different reports only focus on copper cables. It has to be highlighted that aluminum cables may also used in building applications	Potentially include the aluminum cables in the calculation performed	A base case based upon aluminum cables is added to the study.
3	Task 2 and task 5	Task 2 : 26 and Task 5 page 11 and 14	Copper resource	It is mentioned that "copper is becoming a scarce resource" . Indeed, copper is highlighted by Europe as an important material considering resource efficiency. Such aspect should be pointed out and taken into account into the environmental study	Include Resource depletion indicator in the environmental evaluation, specifically when evaluating use of higher cross-sections.	Critical raw materials were recently studied by the European Commission Services and Copper was excluded:: http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm It is not the objective of this study to review this position.
4	Task 3	40	Table 3-15	Average life time of buildings cables seems higher, for residential, than average life time of buildings in Europe.	Re-consider the calculation done for average life time, or get more information from buildings manufacturers on such information	Text has been changed.
5	Task 5	11	BoM	The calculations are done using a simplified approach for cables composition. In LCA studies, some additives or raw materials used in small quantities may induce the most important impact on some indicators	Improve the accuracy of LCA study or highlight that this evaluation is a simplified approach and that some key impacts related to process or raw materials may have been forgotten.	Text in task 5 has been adapted to indicate that the simplified MEErP approach is taken. In the second stakeholder meeting stakeholders were invited to provide more accurate LCA analysis, if they could not agree with the MEErPEcoReport tool use.
6	Task 5	24	Cost for consumer	Any increase in cable cross-section will induce an increase in other electrical accessories costs and building cost due to larger cable management	Consider the increase on building cost related to increase in copper cross-section	This is mentioned in Task 3 and will be discussed qualitatively in Task 7.

ANNEX H COMMENTS AND RESPONSES ON TASK 4 – 5 (VERSION 2) AND ON TASK 6 AND 7 (VERSION 1)

Organisation: Aurubis Belgium	Name: Mukund Bhagwat	Date: November 20, 2014

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	5.3	41	Base case Life Cycle Cost for consumer	Life cycle costs don't take into consideration the residual value of the conductor.	Take into account the residual value of copper when carrying out the economic analysis of the various cases. We suggest to use, as minimum, a 10 year average of Copper price as quoted on London Metal Exchange? This will even out the economic cycle fluctuations. This also applies for sections 6.3 and 7.	Residual value is added in tasks 5, 6 and 7.

MINOR COMMENTS ON THE CURRENT RELEASE OF THE PREPARATORY STUDY by Engineering, Consulting and Design, prof. ing. Angelo Baggini, Ph.D.

Ref. 7.1.2.1.1 Policy measures at product level by a generic ecodesign requirements on information

[...] On the package and sales websites:

- Cable losses per kilometer (VA/kilometer) at 50 % and 100% of the maximum current-carrying capacity of the cable in open air;
- Indication of the real measured DC ohmic resistance according to the compliance check as described in paragraph 7 of IEC 60228 and Annex A of the standard. The DC ohmic resistance is measured on a cable sample of at least 1 meter at a given room temperature and corrected to 20°C and a length of 1 km (R_{20} expressed in Ω/km).

Comments

- losses should be expressed in terms of W/km and not VA/km
- another communicative way to express/represent the DC resistance could be (W/(A km)) instead of ohm. Performing dimensional analysis it’s easy to demonstrate that resistance is a loss per unit of length and per carried ampere (W/(A km)). The value is the same but it should be more meaningful for general users

ECOS on behalf of European environmental NGOs
Comments on draft Tasks 1-7 of the preparatory study for Power Cables
(Lot ENTR 08)

December 2014

Power cables present an important energy saving potential, with up to 13.87 TWh/year by 2025 according to draft Task 7. We therefore welcome their inclusion in the 2012-2014 Ecodesign Work Plan and the subsequent undertaking of this preparatory study.

We consider possible product policies such as Ecodesign requirements or a label as positive and plausible policy options for this product group, and we think that they deserve a more thorough analysis than that implemented so far in the preparatory study. In this context, we invite the study team to reinforce their investigation taking into account the following points:

Objectivity and completeness of study assessment

The dependency on industry-funded studies raises questions regarding objectivity and completeness of the study assessment. Scientific rigour is essential to a study of this bearing. Where data is lacking or withheld, it is important to make reasoned assumptions to fill gaps and ensure the study covers all important considerations and scenarios at sufficient depth.

Scope – exclusion of residential circuits

We regret that it was decided to exclude residential circuits from the scope and believe this is partly a consequence of the study's focus on cross sectional area (CSA). Savings in the residential sector are expected to be smaller but we still consider these to be worthwhile. The policy assessment should include at least a consideration of the applicability of recommendations to the residential sector

Technology options

Options for BAT in relation to materials are overlooked. Technology options should include material efficiency and alternatives to CSA. Research into material efficiency and/or building assumptions may be necessary as there was little stakeholder data provided.

Policy scenarios

The policy assessment is narrow and lacking ambition. It should be improved thanks to a thorough assessment of existing international initiatives and a complete assessment of the range of possible policy approaches. Task 7 should be reworked to consider the full range of policy options available. The goal should be to reduce losses and environmental impacts of power installations, possibly via Ecodesign regulations. A shift towards resistance/impedance (Watts / mm / Amp or similar) as a defining characteristic of cables rather than CSA should be considered.

Resource and Materials:

Resource efficiency considerations should be further explored. The material impacts increase of the suggested CSA solutions are considerable. Copper impacts, especially price fluctuation should be considered in the sensitivity analysis. Whilst some previous assessments found copper to be of low criticality, these assessments did not account for the considerable surges in copper use that would result from increases in the cross sectional area being put forward as technology options in this study. Therefore it is important that this study carries out a proper impact assessment of their recommendations over and above previous studies on criticality.
In addition, technology options should include material efficiency options, such as: alternatives to increased material technology options, alternatives for insulation / sheath material to reduce impacts, options to encourage sheath recycling, assessment of benefits of early replacement, options to encourage recycling of cables within the EU.

The table below lists and further details our comments in this direction.

General reply ofVITO:

On objectivity:

- *We don no agree this because anyone, including ECOS, was invited to fill in and supply enquiries that were sent out twice. Therefore we would rather have seen reaction of ECOS to supply alternative data at the time it was needed and asked for but not after completion. Also, cables are not installed by regular end users but by installers(industry) and therefore it is logical that they supply information .*
- *In general we agree there was a lack of interest and awareness, as we mention in Task 3. We have included policy recommendations to increase awareness that will also source more information. In reaction to this we will add a new section in Task 7 to update this study after 5 years when more information should become available. (section on timing of policy measures)*

Scope:

- *This was discussed and agreed in the beginning of the study. However we agree that in Task 7 a policy recommendation in line with the findings of Task 1 should be added, it is related to the lack of renovation in existing buildings.*

Technology:

- *We do not agree this statement, be more specific which option do you intend and why.*
- *More information on halogen free cables was added in task 3, please note that they as well can be recycled. Hence all materials can be recycled.*
- *As a reaction to this we add in Task 7 a section why no product policy recommendations were given in the framework of this study.*

Policy options:

- *This part will be further elaborated in the final version, nevertheless possibilities matching Ecodesign regulation are limited.*
- *More explanation is given in the introduction of the section on scenarios.*

Resource and materials:

- *All tools in line with MEErP will be available after the study for the EC.*
- *We will add a section that repeats the conclusions on recycling in in the policy recommendations in Task 7.*

DG ENTR Lot 8: Ecodesign for Power Cables in Indoor Electrical Installations

Organisation: ECOS **Name: Catriona McAlister / Chloe Fayole** **Date: 19/12/2014**

Ref.	Section	Page	Topic	Comment	Proposed change	VITO reply
1	General	General Comment	Objectivity and completeness of study	We would like to reiterate a point previously raised by EDF[1]. The dependency on industry-funded studies raises questions regarding objectivity and potential conflict of interest. Whilst we recognise that the study budget is limited, scientific rigour is essential to a study of this bearing. All data should be scrutinised, and findings only taken on board if they stand up to an objective technological assessment. Where data is lacking or withheld, it is important to make reasoned assumptions to fill gaps and ensure the study covers all important considerations / scenarios at sufficient depth.	Where data is provided it should be carefully examined for robustness (for example, see later comments on the low criticality of copper). Where stakeholders do not provide data, we suggest the contractors build scenarios based on assumptions (that can be consulted upon) to ensure the range of options is adequately covered – see further comments in the various areas for details.	We did sent out an extra enquiry and used the received data. Anyone could fill in and contribute, including ECOS. But as noted interest and awareness of stakeholders is weak, therefore other actions are needed as proposed in the policy options
2	General	General Comment	Resource efficiency in: - Technology options: task 4/6 - Policy scenarios: task 7	The contractors stated in the stakeholder meeting an assumption that the focus of Ecodesign is energy efficiency, especially as the title of the product group includes "losses". It was stated that they therefore had not addressed resource efficiency considerations in any depth. In fact: The recast Ecodesign directive (2010/30/EU of 19 May 2010) aims to prompt "manufacturers to take steps to reduce the consumption of energy and other essential resources of the products which they manufacture" The Ecodesign preparatory study tools were recently revised in order to ensure that material efficiency could be properly taken into account2. The reason power cables were prioritised in the working plan 2012 to 2014 was due to their wider environmental impacts.	Work by BioIS on the MEErP methodology and by JRC on material efficiency in Ecodesign can provide direction on how to consider material efficiency in an Ecodesign context. In addition, we suggest that the study contractors appeal to Europacable to provide copies of their studies to inform a deeper analysis of the potential for technology and policy measures including options to improve resource efficiency. The OVAM report referenced in these comments also provides some useful insights. In the event of the Eurocapable reports not being provided, we suggest the contractors make reasoned assumptions. Development of the following should be considered:	A new section explaining potential policy measures related to resource efficiency is added in Task 7.

1 Questions from and answers to stakeholders regarding draft documents Task1-3 (version 2) and Task 4-5 (version 1) published on study website– EDF comment date 04/06/2015,

2 See the BioIS guide for practitioners to analyse material efficiency in ErP by using the EcoReport 2013.

				In addition, Europacable stated in the stakeholder meeting that internal studies had been carried out on the material side and that whilst "technologically there is a lot possible" with regards to improving material efficiency, the barrier is cost. This supports further investigation into the material efficiency considerations in terms of research into technology options and the consideration of policy scenarios.	**Technology:** Options for BAT in relation to materials. E.g. design options featuring alternatives for insulation / sheath material: use of recycled plastics (how policy could resolve manufacturer concerns around quality and encourage greater use – see OVAM report), halogen free sheathing[3], alternatives to PVC[4] (or recycled PVC), PVC as an alternative to XLPE/PEX[5]. Technical alternatives to increased material (CSA) options, even if these need to be considered at a circuit level. Consideration of any other resource efficiency options. See other preparatory studies for examples as to how innovative technology approaches have been considered – for example, the Sound and Imaging preparatory study combined operational mode requirements, product light-weighting, APD and reusable components. **Policy:** Options to facilitate cable recycling (to avoid downgrading the insulation material and to encourage greater recycling - for example of insulation outputs of manual stripping processes)[6]. Assessment of benefits of policy encouraging early replacement (see	

3 The presence of halogen due to flame-retardants and substances of very high concern (SVHC) have a major impact on recyclability of polymers. It is useful to explore how essential these components are and where policy could incentivise a move away from these.

4 PVC used in cabling represents 7% of EU PVC use – some 364 ktonnes, with only 88.5 ktonnes of recycled. Alternatives to traditional PVC include phlalate-free PVC, PE and PFP. Use of bio-plasticisers can facilitate cables with low volatile organic content. Use of technologies such as VinyLoop can recycle PVC from electrical cables for reuse without downgrading (although solutions to get around changes in material colour

and process costs would need to be considered). Flanders PlasticVision / OVAM report: "Proposal on material criteria for the product group: "Cables in Closed Circuits",

5 Alternatives include CPE and EPR

6 For examples of ecodesign policy addressing end of life impacts, please see the November 2014 draft requirements for electronic displays "Annex iii : End of life requirements".

					calculations suggested by the JRC in Annex 5 of JRC Technical Report n° 3.) vi) Policy options to encourage recycling of cables within the EU (currently cables with copper content below 40% are shipped outside EU for recycling[7]).	
3	Task 1, section 1.3 (as background to Task 7)	Page 60	Existing legislation	The assessment of existing international policy states *"A number of building energy guidelines, standards or codes go beyond the existing electrical safety and operational requirements by adopting more stringent maximum voltage drop requirements to limit circuit impedance and thereby wiring energy loss."* This is reiterated in the task 3 report for the working plan[8]): "*In some countries IEC recommendations on max. voltage drop[9] are legal requirements / included in local legislation*." However, only the North American ASHRAE/ IESNA 90.1 standard and the National Energy Code for Buildings of Canada (NECB 2011) are mentioned. The recently revised Californian Energy Commission requirements that include maximum voltage drop requirements are not mentioned. There is no detail on how international policies go further in terms of levels and legislative approach. This is essential information to inform task 7.	A more thorough review of international policy should be implemented under Task 1 to inform Task 7. This should include detail of all the policies that go beyond the existing electrical safety and operational requirements by adopting (for example) more stringent max voltage drop requirements (policy name, policy type/mechanism etc). Detail comparing what the exact requirements are should be included. Other preparatory studies can provide examples of the level of detail at which this has been implemented for other product groups.	Those proposals are in task 7 More identical samples will not influence the outcome.

7 Flanders PlasticVision / OVAM report: "Proposal on material criteria for the product group: "Cables in Closed Circuits", page 4.

8 http://www.ecodesign-wp2.eu/downloads/FINAL%20REPORT%20Task%203%2016-12-2011.pdf

9 [In informative annex of standard IEC 60634-5-52) The IEC recommends a maximum voltage drop at the connection terminals of the electric load (the end point of the circuit) of 3% for lighting circuits and 5 % for other circuits, when supplied from public voltage distribution. And for installations when supplied from private LV power supplies, 6% for lighting circuits, 8% for other circuits.

4	Task 1, summary	Page 10	Scope: Residential circuits Technology options (task 4/6) Policy options (task 7)	It is stated that: - Losses in the residential sector are low - estimated at <0.3% (3.35 TWh), as opposed to 2% in other sectors - Residential cables should be in the scope of Tasks 1, 2 and 7 (partly) but not for Tasks 3-6 on environmental improvement potential. - LLCC solutions could not be identified for residential sector (due to focus on CSA). However, we suggest that the range of technology/policy options considered to date could be widened to consider other options that could result in LLC solutions in residential circuits taking into account that: - When the cables are placed on the market, it is not known in which sector the power cables will be used. - Requirements suggested are focused on information requirements, so savings may be achieved at low or no cost. - Savings in the region of 1TWh are still significant, even if relatively low compared to opportunities in other sectors. - Non CSA measures (e.g. policy means of encouraging shortened circuit length) have not been assessed and may represent a feasible LLCC option for residential	The preparatory study should include: - Alternatives to CSA as a technical solution (and particularly as a metric for policy) - e.g. circuit length/topology that would not have such large material impacts. - At least a qualitative consideration of the applicability of recommendations to residential applications	A section is added in Task 7 related to policy recommendations for cables in the residential sector

5	Task 7, Sectio n 7.1	Page 10	Policy analysis	There are the following issues with the current assessment of possible policy options: i) Thepolicy analysisfocuses on technical scenarios based around increased CSA of cables, rather than policy scenarios. ii) Resource efficiency options are not considered.	As this is a study to assess what could be achieved under Ecodesign legislation, we suggest that in task 7 the study contractors explore innovative policy options complying with i) the Minimum Energy Performance Standard (MEPS), and ii) Energy Label approaches established under the Ecodesign directive. Please see the annex at the end of this document for details. It is worth referencing other preparatory studies to see how these have assessed policy – for example, in the Sound and Imaging policy scenarios, detailed consideration was given to potential levels at which to set policy options based upon the levels currently referenced in existing legislation. The goal should be to reduce losses and environmental impacts of power installations. A shift towards resistance/impedance (Watts / mm / Amp or similar) as a defining characteristic of cables rather than CSA should be considered. Approaches from international policy could be used to inform requirements within these scenarios, and resource efficiency considerations as well as informational aspects could be included.	Labelling does not make sense, the proposed product Information requirement should solve the issue.

6	Task 7, Section 7.4	Page 37 onward	Sensitivity analysis	The study states in task 2 that "*Conductor prices are very volatile, therefore it is common to correct cable prices with a surcharge depending on the market price*." Meeting discussions and previous stakeholder comments suggest there is disagreement as to whether copper can be considered a scarce resource. In previous comments from Nexans[10] they stated *"...copper is highlighted by Europe as an important material considering resource efficiency. Such aspect should be pointed out and taken into account into the environmental study."* Whilst a 2013 JRC assessment considered copper a material of low criticality[11], it is important to consider this study in context. The focus was upon the metals critical to the decarbonisation of the EU Energy Sector – it focused on very specific technologies. In studies addressing different sectors or based upon different assumptions, the results could be quite different. In particular, these studies do not account for the huge increases in copper use that would result from the recommendations being made in this preparatory study. Therefore it is the responsibility of this study to carry out that additional assessment.	Variations in copper price should be considered in the sensitivity analysis. We urge the preparatory study team to more thoroughly evaluate the impacts of the suggested technology options to increase cross section areas of power cables, as it has not been assessed in the previously carried out studies. The assumptions from other studies that copper is non-critical do not account for the impacts increases in CSA would have. We support the change previously suggested by Nexans to *"Include a Resource depletion indicator in the environmental evaluation, specifically when evaluating use of higher cross-sections."*	Insulated copper cables are used in any electrical product and therefore commonly accepted data is included in MEErP. Not agreed. LCA impact from increased CSA is calculated with the MEErP and study model?

10 Questions from and answers to stakeholders regarding draft documents Task1-3 (version 2) and Task 4-5 (version 1) published on study website 26/05/2014

11 "Critical Metals in the Path towards the Decarbonisation of the EU Energy Sector: Assessing Rare Metals as Supply-Chain Bottlenecks in Low-Carbon Energy Technologies", R.L.Moss1, E.Tzimas1, P.Willis2, J.Arendorf2, L.Tercero Espinoza3 et al. (1) JRC – Institute for Energy and Transport (2) Oakdene Hollins Ltd (3) Fraunhofer Institute for Systems and Innovation Research ISI

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Annex - Potential policy to consider in task 7

Possible policy option	Policy/product characteristic	Comments
"Energy" Labelling	A to G labelling of cables according to losses per length cable / maximum ohmic resistance per km (potentially linked to MEPS on worst performing label class).	Innovations to labelling class criteria could be based on material efficiency considerations: ☐ Copper content % (over 45% to ensure recycling in EU) ☐ Ease of plastic recyclability – lack of fire retardants in cables for non-critical installations. Durability considerations etc.
Comment VITO	Thank you for the input. Proposals are in the final version. It has been added in task 3 that halogen free cables are thermoplastic and can and are also recycled. Hence it is not an issue.	
Minimum Energy Performance Standards	MEPS based off loss ratios, maximum voltage drop or similar.	These can be built upon existing international policy requirements, once the necessary research for Task 1 section 1.3 (see comments) is carried out.
Information requirements	Such requirements need to be combined with another policy approach to be feasible. The preparatory study suggests: On the cable, complementary to CSA: o Indication of the maximum DC ohmic resistance per kilometer at 20°C (R20 expressed in Ω/km) On the package and sales websites: o Cable losses per kilometre (VA/kilometre) at 50 % and 100% of the maximum current-carrying capacity of the cable in open air; o Indication of the real measured DC ohmic resistance in line with IEC 60228. (R20 expressed in Ω/km).	The ELEKTRO+ (German) Initiative does some of this, and the Product Environmental Profile (PEP) Eco passport may also provide an additional mechanism to facilitate this information provision.

Comment VITO	We checked elektro-plus.com again and they say much about energy efficiency such as smart submetering but nothing specific on optimizing cables to reduce losses The target are domestic installations , which were not in our scope.	
Recommendations on standards		
IEC/EN Standards, guidance etc	Changes could be possible to the following: i) Recalibrate safety standards to higher CSA for rated voltages. ii) More stringent max resistance in “EN 60228: Conductors of insulated cables”[12] iii) “Harmonized Document 60364-1 (IEC 60364-1)”[13] could incorporate “IEC 60364-8-1: 2013: Low voltage electrical installation Part 8-1: Energy efficiency” which provides a foundation approach to reduce losses. iv) TR 62125 on info provided to user to influence CSA choice.	Wiring codes of EU countries are based on IEC 60364 – so a change this standard could have wide influence. It could be difficult to justify changes in safety standards to reflect energy efficiency drives, especially considering the potential additional cost. For updates to standards to have an influence, they would need to be initiated as soon as possible to avoid in the availability of harmonized approaches at the time the regulation comes into place.
Comment VITO	It is in 7.1.2.2.1.1, we consider to highlight this more.	

[12] Task 11 of the preparatory study states “The maximum resistance of the conductor (Ω/km) is the most important specification related to the energy losses in the power cable”
[13] This document provides the rules for the design, erection, and verification of electrical installations

Organisation: Cenelec TC64 WG29	Name: Peronnet	Date: 28/11/14

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	4.1.4	10	4th bullet (last one)	There is a confusion between the increase of the voltage and the usage of the d.c. current instead of a.c. in the current draft. Clarification shall be made to show that the main benefit came from the increase of the voltage (380V instead of 220V) and not from the the type of current.	1) Replace the current text by the following: **Increase the voltage for power distribution in commercial buildings may improve the efficiency as it reduces the current flowing in the cables.** 2) If 1 not accepted, Replace the current text by the following: **Increase the voltage for power distribution in commercial buildings may improve the efficiency as it reduces the current flowing in the cables.** **As an example, 380 VDC/24VDC power distribution instead of 110 or 230 VAC in commercial buildings, as promoted by the EMerge Alliance3.** Also other initiatives like lighting systems powered via Power- over-Ethernet (PoE)4 are examples of this trend towards smart DC grids integrating power distribution for lighting, ICT and Building Automation networks. The rationale is that cable insulation is related to the peak voltage(Vpeak). In AC systems peak voltage is Vrms.√2 = 325 Vpeak. In DC systems the peak voltage is equivalent to the VDC. As a consequence an identical cable with identical insulation would need less current in DC (e;g.: 325VDC, 1A, 325 VA) compared to AC (e.g. 230 Vrms, 1.41A, 325 W) and will therefore reduce	Text has been adapted. Impact of DC is on thickness of insulation and not on losses.

2	6.5	43	2nd paragragh	Avoid confusion. It is said in the first paragraph “nothing was identified in Task 4, as a consequence that there is also no further analysis” which seem to be a conclusion. And then it is suggest in a second paragraph that there is only a solution which is too difficult to implement. You may also explain that 220VAC used in Europe is already far more efficient than the 110VAC used in many countries such as USA. Please remain on your conclusion.	Delete the whole paragraph (line 11 to 19) below: At circuit system level section 4.1.4 referred to 380 VDC systems replacing 230 VAC. The rationale was that cable insulation is related to the peak voltage(Vpeak). In AC systems peak voltage is Vrms.√2 = 325 Vpeak. In DC systems the peak voltage is equivalent to the VDC. As a consequence an identical cable with identical insulation would need less current in DC (e.g.: 325VDC, 1A, 325 VA) compared to AC (e.g.: 230 15 Vrms, 1.41A, 325 W). Cable loss will therefore reduce by half $(1/.\sqrt{2})^2$ in DC compared to AC. As mentioned in section 4.1.4 such a switch from AC to DC would require another power distribution system which is so far not a viable improvement option today (10/2014).	Paragraph has been updated and grouped in a single point The reference to 110 VAC is removed and also the related text.

3	*7.1.1*	22		Here is a proposal as requested.	It is important to understand that cables are not a product but a means to carry power. It is therefore important to take into consideration the usage of the load or application for the whole installation to maximize the efficiency of the wiring system. The brand new HD 60364-8-1 standard gives guidance to optimize the efficiency of the whole electrical installation where the wiring system is part of it. To maximize the efficiency of the wiring system during the life time of the electrical installation, it is key that the HD 60364-8-1 shall be implemented by each Cenelec country as soon as possible. As it will be implemented in the design software as it is base on the other part of HD 60364, it should be quickly implemented at the European level in a transparent and efficient way.	Proposed text has been added to the paragraph.
4	*7.1.2.2.1.1*	13	Line 30	Please, refer to the HD 60364-8-1:2015 which will be ratified on the 2014-12-22 and available on the 2015-01-23 (see on Cenelec web site)	Replace "prIEC 60364-8-1 and/or its EN 30 equivalent" by "HD 60364-8-1".	Replaced
5	*7.1.2.2.1.2*	14	Line 6	Please, refer to the HD 60364-8-1:2015 which will be ratified on the 2014-12-22 and available on the 2015-01-23	Replace "prIEC 60364-8-1 and/or its EN 30 equivalent" by "HD 60364-8-1".	Replaced
6	*7.1.2.2.1.3*	14	Line 26	Please, refer to the HD 60364-8-1:2015 which will be ratified on the 2014-12-22 and available on the 2015-01-23	Replace "prIEC 60364-8-1 and/or its EN 30 equivalent" by "HD 60364-8-1".	Replaced

Organisation: Europacable	**Name:** Annette Schermer (a.schermer@europacable .com; M:+31610639725)	**Date:** 18 December 2014

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	Task 5 – 5.1.2	16	Table 5.3	Phthalate has been modeled by Bitumen, which is a quite different product. Environmental impact of bitumen versus phthalate varies between 30 and 300%, depending on the environmental indicator considered.	Highlight that the phthalate plasticizer is very different from Bitumen, and that for such approximation, a sensitivity analysis should be carried out before.	A small sensitivity analysis is added in Task 5 and the overall impact on the outcome is low. Text is added.
2	Task 6 – 6.1	11	Impact assessment	It is mentioned that "the design option should have a significant potential of improvement without deteriorating others …" Considering the base cases this will have a significant impact on resource consumption as well as on weight and volume of the product and other systems parts which will be affected by larger sizes, which are not reported in this report. Information on raw materials quantities for design options D1, D2 , D3 and D4	Mention in the summary, that all design options considered, as long as different from BAU, will have a significant negative impact on resource consumption, which has not been quantified. Possible positive energy efficiency solutions should be carefully weighted against negative impacts on other environmental aspects. Considering Impact on product weight and volume, provide the table with Volume and product weight for all the design options consider and highlight the expected negative impact for parts, installation and installers work conditions.	Added tables with the increase of material usage per design option. Added table showing volume increase. Also mentioned the negative impact of the design options on resource consumption in the summary.
3	Task 6 – 6.1	11	Impact assessment	No manufacturing process have been considered	Highlight that using the MEErP report tool, no manufacturing process have been considered and that part of manufacturing process on Life cycle impact is unknown. Mention also that the higher the cross section design options considered, the higher the over-estimation, as for high cross-section, the part of manufacturing impact is higher.	Introductory text has been added explaining the MEErP and how the impact from manufacturing is modelled with this.

4	Task 6 – 6.1	11	Impact assessment	Increase of cable cross-section will lead to modification of accessories and buildings (more space needed).	Highlight that the impact of involved design options on other installation parts (and even building constructions) have not been considered. If legal requirements are considered, they should be based on a holistic evaluation of all environmental impacts of product requirements and take into account the environmental impact of higher volumes of raw materials for the products itself and the accessories, parts and constructions materials related to cable size increase. (See also point 2.)	See comment 2.
	Task 6 – 6.2.1 (and possibly others)	13	Impact per parameter (ex energy)	It's not clear in the Task 6 what the reference case is for evaluation. For example is the Total Energy Consumption at 6.2.1 referring to a certain quantity of cables (considered in the different design options) or to the total quantity of cables in the markets of each BC scenarios? The same question applies to all the other evaluation parameters in addition to Total Energy Consumption.	Specify in a more transparent way the functional unit of Task 6 evaluations	These tables show the life cycle impact per base case over the product lifetime. In Task 5 tables 5-9 till 5-17 showed the impact for the BAU the life cycle impact per base case **per year**. Multiplying by the product life time factor (25 years) results in the BAU value in Table 6-2. Added
5	Task 6 – 6.2.3	33	Impact assessment	No information is provided on resource efficiency.	Even if not calculated, inform that in terms of resource efficiency, the best performing design options is always the BAU case.	Added.
6	Task 6 – 6.2.3 - Table 6-21	33	Conclusion	Technical feasibility of moving from BAU to D3 should be confirmed by installers.	Mention that the technical feasibility and potential consequences of moving from BAU to D2 and D3 have not been reviewed.	Text is added in the summary and section 6.1 to indicate the task 6 assumptions regarding technical feasibility and other consequences.
7	Task 6 – 6.3	34	LCC	It is stated that calculations are based on formulas of tasks 2, 3 ,4. Task 2 chap. 2.4.1 stipulates an expected market price increase of copper.	Scenarios of LCC and related payback period should be developed taking into account the expected market price increase of copper (and other raw materials).	A sensitivity analysis regarding the product price is added in task 6 showing the impact of a lower or higher product price on the BAT & LCC design option.

8	Task 6 – 6.3	34	LCC	It is stated that calculations are based on formulas of tasks 2, 3 ,4. Task 2 chap. 2.4.5 stipulates "no disposal costs"	Scenarios of LCC and related payback period should be developed taking into account the real expected disposal cost.	New assumptions are added taking into account the 'disposal' cost including the residual scrap value.
9	Task 6 – 6.3 - Table 6-21	36	LCC	In table 6-19, the environment pay back has been highlighted in red when not convenient. The same should be done for table 6-21	Color the cell of SPP, using the same color as the one of table 6-19, to highlight when there is an interest or not in terms of LCC.	Color scheme has been added.
10	Task 6 6.6	80	Sensitivity	Table 6-32, 6-42 and 6-53 show the impact of the sensitivity analysis and that the best design option varies, depending on the assumptions used (specifically for the circuit use, considering BAT)	Conclude that the robustness of the study highly depends on with the different assumptions for BAT and LCC.	The sensitivity analysis is used to indicate the (trend) impact of different parameter value assumptions. A general conclusion regarding robustness of the study is added in the summary.

TASK 7

Ref.	Section	Page	Topic	Comment	Proposed change	VITO reply
11	Summary	10	Summary	The summary concludes on a saving of 15.75 TWh for the BAT and 13.87 TWh for LLCC. The cable is not a "stand-alone" product and is connected to other parts (accessories) and included in a building. The impact of cable size modification on accessories and buildings has not been evaluated. The burden is then shifted to other elements which have not been considered.	Inform that the study only focused on cables and did not take into account cable modification consequences on accessories and buildings. The conclusion of 15.75 TWH and 13.87 TWH are only considering cable, and would be lower if the total installation and building would have been considered.	Added this information in the summary.

12	Task 7 – Tas k-7.1.2.1.1	1 - 22	Policy measures at product level	The indication of DC resistance on the cable sheath will not bring any additional information supporting the installer for reducing cable losses. It will only create supplementary costs for the cable manufacturers. The proposed saving strategies are all based on standardized and already existing cable CSA (Task 3 chap. 3.1.2.2). The max. DC resistances are all prescribed in the corresponding cable standards. The saving strategies can only be implemented through the installation standards. The ecodesign is finally made on circuit level taking into account the cable losses through their DC resistance. It is not feasible to measure the real DC ohmic resistance of all cables. This is why the standards have been set up on conductors: to ensure to customers on a maximum ohmic resistance of the product they buy. Cables are produced in either long or short lengths, and when produced in long length, can be cut after distribution. Real measurement of DC would imply to measure ALL products manufactured, one by one, which is not feasible in terms of time needed.	Max. DC resistance is already indicated in all technical cable datasheets. There is no need to indicate it on the cable itself. Remove the second bullet point and lines 27-29	Bullet point has been moved to the notes together with the explanation in this comment.
13	Task 7 – 7.1.2.1.1	10	Policy measures at product level	“”The enquiry has demonstrated that installers are unaware of cable losses.”	The reference document states the contrary. This should be corrected, since installers who filled in the questionnaire have responded positively on the question about their knowledge of energy losses in cables.	Sentence has been changed.
14	Task 7 – Task 7 – 7.1.2.1.1	11	Policy measures at product level	Remarks on measures for insulation material are not relevant. Insulation material is not related to energy efficiency. If this remark relates to resource efficiency, then this indicator needs to be consistently considered in all the task 6 and 7 before any conclusions concerning policy	As long as resource efficiency has not been considered in the task reports 6 and 7, remove the remark.	Taking into account also the comments from ECOS a new section was added 7.1.2.1.2

15	Task 7 – 7.1.2.2.1.1	13	Lines 6-7	"Mentioning a reference to this economic optimization tools on the cable package". People buying and installing cable products are not the ones designing the electrical installation. They usually even not work for the same company. Information on optimization tool on the cable will not be seen by installation designers. Also an optimization tool should be an objective, independent tool for all manufacturers. So reference cannot be made to tool a=of individual manufacturers.	Remove this bullet point	Agreed, text has been updated that the tool should be standardardized among manufacturers
16	Task 7 – 7.1.2.2.1.1	13	Line 32	"a new standard on calculation of cables losses …". A standard already exist (IEC 60287-3-2) on the economic optimization of power cable size, taking into account cable cost, losses and other parameters. What may be developed is a standard on installation economic optimization, taking into account losses and additional cost related to cable size optimization as well as accessories and building necessary modification.	Modify "cable losses" by "electrical installation economical optimum, related to losses, cables, accessories and building".	Agreed. Text is modified and added: ..the standard refers to standard IEC 60287-3-2 ..
17	Task 7 7.2.1.2	15	BAT scenario	Why do the BAT scenarios in Task 7 refer to certain "Design Options"? How are such Design Options related to BAT scenarios for each Base Case from Task 6 report)?	Explain how the Design Options have been based on the BAT scenarios and other scenarios.	More explanation about the rationale for scenarios is added
Bout	Task 7 7.2.2.5 Ex. Fig 7-13	30	Annual emissions of CO2 eq	In Task 7 apparently the results of the evaluation (for example the reduction of GWP from losses – fig. 7-13, page 30) refer to a total quantity of the cables produced. Is it the total produced in one year in Europe, or other?	Specify in a more transparent way the functional unit of Task 7 evaluations.	As indicated in this comment, the figures are calculated for the total stock .This was also mentioned in 7.2.1, but this sentence is moved to 7.2 and is more elaborated.
19	Task 7 Fig. 7-14 (7.2.2.5)	31	GWP from EOL	Fig. 7-14 page 31: Why the impact of EOL is lower with the "BAT" scenario? The BAT scenario is referred to a certain Design Option which depends just on section of cables (see Task 6 report), therefore it's not clear how this may make such difference in term of EOL impact!	Explain better the assumptions on which the EOL results are based.	The EOL, as explained on p. 31, is due to the fact that after scenario introduction time + product life (25 years), there will be a lot more material that will be recycled and thus resulting in larger EOL recycling benefits compared to BAU.
120	Task 7 – 7.3.1	35	Sales and expenditures	Figure 7.17 presents annual sales and figure 7-19 shows annual expenditures. A graph should present the total cost, including both increased annual sales and reduced electrical losses.	Add a graph cumulating sales and costs of losses. Do the same for 7.4.1.5 and 7.4.2.1	Graphs are added.

21	Task 7 – 7.4.		Sensitivity analysis	No global conclusion on the sensitivity analysis is provided	Conclude on the robustness of the study, considering the sensitivity analysis.	To be added (after definition new scenarios)
22	Tas and Task jointly		In general	It's not clear how the results of task 7 and the results of task 6 should be jointly considered: in the task 6 we have different design options, in the task 7 apparently some design options are combined with LLCC scenarios.	Explain better how the Task 6 and Task 7 results are linked together and how they should be jointly interpreted.	More explanation about the rationale for scenarios is added

Organisation: European Aluminium Association	Name: Bernard Gilmont	Date: 19.12.2014

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	TASK 5 5.2	21-40	Environmental impacts	Clarification should be given about the environmental crediting methodology at end of life (e.g. calculation rules and parameters used for the various materials). It is effectively important to understand how the results can be derived from the bill of material and the end of life scenarios from section 5.1.5. Currently, this linkage cannot be established by lack of information. For metals, it should be noted that the crediting factor included by default in the eco-report tool is unfortunately very low, i.e. 40%, meaning a downgrading of 60%, which does not match with our views.	We would like to know whether the default 40% crediting factor for end-of-life in Ecoreport tool has been used, or whether it has been overwritten by a more realistic value.	Corrected to 70%.

Organisation: European Copper Institute	Name: Fernando Nuño	Date: 11 November 2014

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply

1	2.4.1	Page 29 Line 28	Copper availability	*"However according to Europacable, referring to a JRC study, copper is becoming a scarce resource."*
				
				• Such JRC study (http://sa.jrc.ec.europa.eu/uploads/ecodesign-Application-of-the-projects-methods-to-three-product-groups-final.pdf) has the purpose to test tentative methods for the assessment of resource efficiency parameters (reusability/ recyclability/ recoverability - RRR, use of relevant resources, recycled content, use of hazardous substances, durability) through a few case studies (washing machine, LCD TV...)
				• The JRC document describes a testing exercise. However, the applicable criteria as per today in the field of material efficiency are defined by the MEErP module on material efficiency http://meerp-material.eu/: **"Material-efficiency Ecodesign Report and Module to the Methodology for the Ecodesign of Energy-related Products (MEErP) PART 1: MATERIAL EFFICIENCY FOR ECODESIGN Final report to the European Commission - DG Enterprise and Industry 5 December 2013"** In this document, it is clearly stated that the parameters selected as the most suitable are:
				  ○ Recyclability Benefit Rates
				  ○ Recycled Content
				  ○ Lifetime
				  ○ Critical Raw Material Index
				• Copper has 1) outstanding recyclability rates (Preparatory Study Table 3-17 states 95%), 2) very long lifetime and 3) it is out of any official critical raw material list (http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm).
				• JRC has made several other studies in the past with the purpose of assessing the risk of disruption / depletion of metals:
				  ○ Critical Metals in Strategic Energy Technologies (http://setis.ec.europa.eu/system/files/CriticalMetalsinStrategicEnergyTechnologies-def.pdf). This report excludes copper from the list of critical metals as its demand to fulfill the SET-Plan is below 1% of world supply. World supply is currently above 20 Mtons/year, 1% means >200 kTons/year, which is above the range of impact expected from the application of any improved scenario (as per the current version of the Preparatory Study). Such impact on worldwide copper demand is considered by JRC as not leading to a critical level.
					Replace the reference to JRC study by the reference to http://meerp-material.eu/: **"Material-efficiency Ecodesign Report and Module to the Methodology for the Ecodesign of Energy-related Products (MEErP) PART 1: MATERIAL EFFICIENCY FOR ECODESIGN Final report to the European Commission - DG Enterprise and Industry 5 December 2013"**.
					
					If collateral literature is to be mentioned, then add the following:
					• Critical Metals in Strategic Energy Technologies (http://setis.ec.europa.eu/system/files/CriticalMetalsinStrategicEnergyTechnologies-def.pdf).
					• Critical Metals in the Path towards the Decarbonisation of the EU Energy Sector (http://setis.ec.europa.eu/system/files/Critical%20Metals%20Decarbonisation.pdf).
					• European Commission (http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm).
					• American Phisical Society - Panel on Public Affairs & The Materials Research Society – Energy Critical Elements: Securing Materials for Emerging Technologies (2011) (http://www.aps.org/policy/reports/popa-reports/upload/elementsreport.pdf)
					• United Nations Environment Programme – Critical Metals for Future Sustainable Technologies and their Recycling Potential (2009) (http://www.unep.fr/shared/publications/pdf/DTIx1202xPA-Critical%20Metals%20and%20their%20Recycling%20Potential.pdf)
						A reference to the new MEErP study is added, nevertheless it does not contain a precise estimate.
						
						Therefore, the stock of cables is now compared with the USGS estimate of global undiscovered copper resources (3500 M tonnes) and a statement is made that a price increase sensitivity analysis will be done in Tasks 6&7.

				○ Critical Metals in the Path towards the Decarbonisation of the EU Energy Sector (http://setis.ec.europa.eu/system/files/Critical%20Metals%20Decarbonisation.pdf). This report concludes that overall risks for copper are low (at any of the following criteria: supply constraints, geographic concentration, political risk) • Other relevant institutions discard as well the criticality of copper in the achievement of any future energy scenario: ○ European Commission (http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm). ○ American Phisical Society - Panel on Public Affairs & The Materials Research Society – Energy Critical Elements: Securing Materials for Emerging Technologies (2011) (http://www.aps.org/policy/reports/popa-reports/upload/elementsreport.pdf) ○ United Nations Environment Programme – Critical Metals for Future Sustainable Technologies and their Recycling Potential (2009) (http://www.unep.fr/shared/publications/pdf/DTIx1202xPA-Critical%20Metals%20and%20their%20Recycling%20Potential.pdf)		
n	2.4.5	Page 38 Line 15	Energy rates	Check that the economic analysis of LLCC has considered harmonized (in time) prices for electricity and for cables. Cable price update corresponds to June 2014. Same should apply to electricity prices (i.e. 2010 prices corrected by inflation and electricity price increase for 4 years, as indicated in MEErP methodology)		Prices have been adjusted.
3	7.1.2.1.1	Page 11, Line 22	Policy measures at product level by a generic ecodesign requirements on information	• Together with resistance, it would be welcome to give a figure of annual energy losses for a limited number of predefined load profiles (dedicated circuit high load, dedicated circuit low load, distribution circuit…). • Such information could also be present in the design software commercially available. And also in the tools offered by cable manufacturers, which many already include the economic optimization on life cycle basis (some examples:) ○ TKF http://www.tkf.nl/producten_portal/cablecalculator/lowvoltage/ ○ Draka http://www.draka.nl/producten/kabelberekening.asp?menuid=8 ○ Nexans http://www.nexans.be/eservice/Belgium-en/navigate_270893_265_40_11239/EcoCalculator.html ○ Top cable eco matic http://www.topcable.com/ecomatic/index.php		Added in the policy measure.

				○ Nexans EasyCalc http://www.nexans.fr/eservice/France-fr_FR/navigate_322622/NEXANS_EASYCALC.html		
4	7.1.2.2.1.1	Page 13, Line 13	Specific ecodesign requirements to increase CSA and lower cable losses	"For this, the installer has to provide additional information like circuit length and load (load factor and load form factor or equivalent operating time at maximum loss) of the circuit." Load factor and load form factor have a decisive impact on the results. Too much freedom on its selection could lead to gaming behaviour by designer or installer to minimize investment cost at the expense of a higher life cycle cost. Here again, a number of predefined profiles could be of help.		Added in the proposed policy measure
5	7.1.2.2.1.1	Page 13, Line 19	Specific ecodesign requirements to increase CSA and lower cable losses	"HD 60364-5-52:2011 (IEC 60364-5-52:2009) defines two correction factors to determine the maximum allowable current-carrying capacity of an electric circuit; these are the method of installation and the ambient temperature. A third correction factor based on the load factor of the electrical load could be applied." As in the previous comment, the choice of the load factor could/should be limited to a number of predefined profiles, so as to avoid gaming.		Text added
6	7.1.2.2.1.1	Page 13, Line 22	Specific ecodesign requirements to increase CSA and lower cable losses	"An alternative approach is to introduce more stringent voltage drop limitations in the standard. (TBD)" Limiting voltage drop has been already analyzed by ECI, but this proposal fails to capture the savings potential, while introducing a burden that translates into higher investment costs that don't generate relevant loss reduction. Study will be forwarded.		Noted
7	7.1.2.2.1.2	Page 14, Line 1	Generic information requirements on the provision of information	"An economic analysis for circuits with a high load factor should be provided as part of the technical file of the electrical installation to be approved by the building owner." Would this measure be just informative to the building owner, or would there be an obligation to design to		The obligation is to design the LLCC, but they can still play around with the load profile.

			to decrease cable losses before commissioning of the electric circuit	LLCC?		
8	7.1.2.2.1.2	Page 14, Line 6	Generic information requirements on the provision of information to decrease cable losses before commissioning of the electric circuit	"Note: it is proposed to include this in an updated prIEC 60364-8-1 and/or its EN equivalent. This could be aligned with the standard IEC 60287-3-2 that describes an economic optimization method." We wish to highlight the importance of including the economic cable sizing optimization in IEC 60364-8-1.		This is difficult taking into account the revision cycles of those standards (5 years)
9	7.1.2.2.1.4	Page 14, Line 40	Requirements for monitoring of cable losses with BACS during operation of the building	"For consideration: monitor cable temperature instead of measuring the loading current." This method seems to be much less accurate. Many factors influence cable temperature. This method would also lead to investments (required for temperature monitoring), but would deliver poorer results.		Noted, added: **..**it is less accurate but could be less expensive
10	7.1	Page 10	Policy Analysis	At some point it would be welcome to indicate which existing legal instrument or other mechanism could be applied to implement the suggested measures.		This is now added in the beginning of the sections

Organisation: Federal Institute of Materials Research and Testing (BAM Germany)	Name: Daniel Hinchliffe	Date: 07.11.14

I thank the consultants for their efforts conducting the study, please find some general draft comments below.

Ref.	Section -	Page	Topic	Comment	Proposed change	VITO reply
1	Task 1, 2, 3, 4, 5, 6	II	Executive Summary	In task 7 it states that an overall executive summary is planned. If this overall summary does not replace the executive summaries in each individual task, it would be more useful if these smaller summaries give a summary of the Task findings in this section, instead of an introduction to the MEErP.	Give overview of Task results. Or change title to Introduction instead of Executive Summary.	Only one overall executive summary for all tasks will be kept.
2	Task 2 Line 27 And subsequent section 2.4.1.1 Copper	29 and 33	Copper availability	"The European Copper Institute confirmed that copper is **not** becoming a scarce resource." This is possibly too strongly worded and emphasized. In their comments ECI stated: "As for copper scarcity, please note that according to USGS data, since 1950 there has always been, on average, 40 years of copper reserves and over 200 years of resources left." Depending on how you interpret this, copper can be deemed scarce, and certainly not infinite. It may be more neutral to write "According to The European Copper Institute, copper is not becoming a scarce resource." Furthermore, the infographic on the copper institute's website states: http://www.copperalliance.eu/industry/economy "Trends are emerging which have pushed up the price: A tonne of mined copper ore now yields 30% less copper than in 1990… only 6% of copper resources discovered in the last decade have been upgraded to reserves… more than a fifth of world copper will come from Peru, Congo and Zambia by 2016 – all high risk conflict areas." The definition of criticality is based upon the risk of supply interruption. Nevertheless, China/Asia's current demand dwarfs that of the EU. It can be expected that environmental impacts increase as extraction becomes harder.	It is understood that determining resource criticality is not the purpose of the study; however increased resource use resulting from regulation is a sensitive issue and a slightly more balanced presentation of the issue would be appreciated, i.e. not emphasizing viewpoints in bold type.	Wording has been changed. Text added: When comparing the global estimated copper resources of 3500 million tonnes with the estimated stock (see 2.2.2.3) of 3,25 million tonnes in non-residential services buildings in the EU it is only about 0,1 %. Therefore increasing over time the stock with 50 to 100 % will not exhaust the global copper resources however it can have an impact on the product price, which will be taken into account in the sensitivity analysis in Tasks 6&7.

3	Task 7	General Comment		Given the impact of increased CSA on copper usage, it would be valuable to have a direct comparison of increase in copper (or aluminium) usage vs. energy savings for each policy intervention across the EU. Copper remains a valuable resource, even if not scarce at this time. The transition to low carbon economies will also increase the demand for copper. What would be the consequences of potentially increasing EU copper cable demand requirements by 2.5x? If cables represent about 50% of usage, this implies increasing EU copper demand by 125% (though of course industry/service sector will only be a fraction of this).	Add section which weighs up the pros and cons of increased copper resource use vs. energy efficiency?	See previous remark. Agreed that a simular exercise could be done taking into account all product groups (motors, ..), but this is outside the scope of this study.
4	Task 7			It is good to see that a sensitivity analysis has been carried out. A further cross check of circuit/building stock rates may be possible by using the usage rates for refined copper over the last 20 years. These have been constant at around 4,200,000 metric tonnes per year in the EU since at least 1980 (or EU-27 at ca. 3,000,000 tonnes). Secondary material/recycling rates also remain relatively constant at around 41-45%. If on average the copper cable usage is about 50%, then it may be possible to calculate a stock rate for comparison. See regional split on page 37 of the ICSG 2014 fact book: http://www.icsg.org/index.php/press-releases/finish/170-publications-press-releases/1959-2014-world-copper-factbook Other studies use EU new building rates of e.g. 0.5% and renovation rates of 1%. See e.g. p107 http://www.bpie.eu/eu_buildings_under_microscope.html#.VFubaJ0wdHg	Make cross check of stock growth/sale rates with copper usage statistics. If sales rates are not increasing, the stock growth rate over time reduces, from e.g. annual 4% in 1990 to 1% in 2050, i.e. additional rather than compound interest.	Additional growth/sales rate is used now in task 7. The results are checked with the predicted copper sales in the working plan. Building growth rates differ per sector (see task 2). Sensitivity case 1 shows the results when using smaller growth rates.

ANNEX I STAKEHOLDER LIST ON 18TH FEBRUARY 2015

Id	Company / organisation name	Relevant sector	Website	Salutation / Title	First name	Surname	Your job title / position	Country
1	VITO	Environmental NGO	www.emis.vito.be	Mr.	Karel	Styns	pc guy	BE
2	Technetium Consulting Oy	Consultant	www.technetium.fi	Mr.	Mika	Kapanen	CEO / senior adviser	Finland
3	European Aluminium Association AISBL	Other	www.alueurope.eu	Mr	Bernard	Gilmont	Building & Transport Director	Belgium
4	Finnish Safety and Chemicals Agency (Tukes)	Public official			Kati	Kyyrö	project worker	Finland
5	Oekopol	Other	www.eup-network.de/		Laura	Spengler	Environmentally sound products	Germany
6	Oekopol	Other			Julian	Wortmann	Assistant	Germany
7	GE	Other			Susan	Bell	Counsel	Belgium
8	ESB Networks	Other	WWW.ESB.IE	Mr	Anthony	Walsh	Specification Manager	Ireland
9	Nexans Deutschland	EU manufacturer	www.Nexans.de		Friedrich	Müller	Director Standardization	Germany
10	CLC TC20 Secretariat	Other		Mr	Helmut	Myland	Secretary CLC TC20	Germany
11	Swiss Federal Office of Energy	Public official	www.bfe.admin.ch	Mister	Roland	Brueniger	Program Manager	Switzerland
12	Federal Environment Agency Germany	Public official	www.uba.de		Andreas	Halatsch	employee	Germany
13	Prysmian Group	EU manufacturer	http://prysmiangroup.com/en/index.html		Annette	SCHERMER	Corporate HSE manager	Italy / Netherlands
14	Japan Business	EU	http://www.jbce.org	Mr	Akihito	Nakai	Secretariat	Belgium

	Council in Europe	manufacturer						
15	Federal Environment Agency (Germany)	Public official		Dr.	Ines	Oehme	technical officer	Germany
16	The Federation of Finnish technology Industries	Other			Carina	Wiik	Advisor	Finland
17	The Federation of Finnish Technology Industries	EU manufacturer	www.teknologiateollisuus.fi	Adviser	Patrick	Frostell	Adviser	Finland
18	Reka Cables Ltd	EU manufacturer	www.reka.fi		Jan-Peter	Lönnquist	Technology Director	Finland
19	Helkama Bica Oy	EU manufacturer	www.helkamabica.fi	Mr	Timo	Vesala	Managing Director	Finland
20	NL Agency	Public official			Hans-Paul	Siderius	senior adviser	The Netherlan ds
21	JRC-IPTS	Researcher			Hans	Moons	Scientific project officer	Spain
22	AIE	Installer	www.aie.eu	Mrs	Evelyne	Schelleken s	General secretary	BE
23	Europacable	EU manufacturer	www.europacable.com		Volker	Wendt	Director Public Affairs	Belgium
24	NEXANS / EUROPACABLE	EU manufacturer	www.nexans.com		Charlotte	INGOLD	Sustainable Development Marketing Manager Europe	France
25	Nexans Norway AS	EU manufacturer		Senior Technical Manager	Ivar	Granheim	Techncial Manager	Norway
26	Agoria	EU manufacturer	www.agoria.be		Tim	Hamers	Junior expert	Belgium
27	Winton Craig Consulting Ltd	Consultant		Mr	Winton	Smith	Director	New Zealand
28	NEC Europe	EU manufacturer			Lars	Bruckner	senior advisor environment	Belgium

29	Europacable	EU manufacturer	www.europacable.com	Mr	Thomas	Neesen	Secretary-General	Belgium
30	Tele-Fonika Kable Sp. z o.o. S.K.A.	EU manufacturer	www.tfkable.com		Jakub	Siemiński	Chief of Technology Department	Poland
31	TELE-FONIKA Kable Sp. z o.o., S.K.A.	EU manufacturer	http://www.tfkable.com/	PhD	Mariusz	Tokarski	Bare Products Technology Manager	Poland
32	EU Issue Tracker	Other	http://www.euissuetracker.com/en/Pages/default.aspx	Mr.	Lorenzo	Torti	Energy Policy Analyst	Belgium
33	European Copper Institute	EU manufacturer	www.eurocopper.org	Mr	Fernando	Nuno	Energy & Electricity Portfolio Manager	Spain
34	OVAM Flemish Public Waste Agency	Public official			Lore	Mariën	policy advisor	Belgium
35	Norwegian Water Resources and *Energy Department	Public official	www.nve.no	Mrs.	Kirsti Hind	Fagerlund	Senior Adviser	Norway
36	Toshiba of Europe Limited	Other			MICHIO	IKEDA	Senior Manager, Toshiba European Enviornment Office	Germany
37	Atlantic Copper	EU manufacturer		Mrs	Manuela	Ramirez	Director of Studies & Institutional Relations	Spain
38	Swiss Federal Office of Energy	Public official	www.bfe.admin.ch	Mister	Roland	Brueniger	Program Manager	Switzerland
39	Epson Europe B.V.	EU importer	www.epson.eu	Mr.	Boris	Manev	Environmental Specialist	Netherlands
40	Bundesverband des Elektro-Großhandels	Other	www.veg.de		Darius	Kremer	Corporate Counsel	Germany

	(VEG) e.V. / German Association of Electrical Wholesalers							
41	TECNOLEC vzw	Other	www.tecnolec.be	Mr.	Danny	Hermans	Coördinator Elektrotechniek	België
42	Swedish Energy Agency	Public official			Lina	Kinning	programme manager	Sweden
43	Öko-Institut	Researcher	www.oeko.de		Jens	Groeger	Senior Researcher	Germany
44	Agoria	Other	http://www.agoria.be		Marc	Cumps	senior expert	belgium
45	Federal Environment Agency	Public official			Ines	Oehme	scientific officer	Germany
46	EDF	Installer	http://www.edf.com	Mr.	Francois	GONCZI	Policy Advisor	FRANCE
47	CLASP	Other	http://www.clasponline.org/	Ms	Marie	Baton	Senior Technical Advisor	Belgium
48	Pentair THermal Management	EU manufacturer	www.pentairthermal.com	Mr.	Gerry	De Blick	Approvals & Compliance Manager	belgium
49	ECOS	Environmental NGO			stamatis	sivitos	Ecodesign policy officer	Belgium
50	Norwegian Wter Resources and Energi Directorate	Public official	www.nve.no		Knut	Knutsen	Senior Advisor	Norway
51	Oeko-Institut	Environmental NGO			Eva	Brommer	Research assistance	Germany
52	Berufsschule Zistersdorf	Other			Peter	Markovics	Teacher	Österreich
53	Pentair Thermal Management	EU importer	www.pentairthermal.com	Mr.	Vital	Eerlingen	Application Development Engineer	Belgium
54	EDF	Researcher			Maud	Franchet	research engineer	france
55	Viegand Maagøe	Consultant		Miss	Annette	Gydesen	Chief Project Manager	Denmark

56	European Commission DG ENV	Public official			Ferenc	Pekar	policy officer	Belgium
57	European Copper Institute	Other	http://www.eurocopper.org	Mr	Hans	De Keulenaer	Director - Energy & Electricity	Belgium
58	U.I.Lapp GmbH	EU manufacturer	http://www.lappkabel.com/		Werner	Sottek	Productmanagement Cables	Germany
59	Danish energy Agency	Public official	www.ens.dk	Mr.	Peter	Nielsen	Senior Policy Advisor	Denmark
60	Aurubis Belgium	EU manufacturer	http://www.aurubis.com/en/aurubis-copper-copper-recycling-copper-alloys/	Mr.	Mukund	BHAGWAT	Corporate Energy Affairs	Belgium
61	Eldra BV	EU manufacturer	www.eldra.nl	Ing	Jan	Fleuren	manager R&D	Netherlands
62	Compliance & Risks	Consultant	www.complianceandrisks.com		Sarah-Jane	Denton	Head, Legal Data Team	Ireland
63	Viegand Maagøe	Consultant	http://www.viegandmaagoe.dk/en/	Miss	Baijia	Huang	Engineering consultant	Denmark
64	Vieand & Maagoe, Denmark	Consultant	www.viegandmaagoe.dk		Anne	Svendsen	Project manager	Denmark
65	NEC Europe	EU importer			Lars	Bruckner	Senior Adviser Environment	Belgium
66	Federal Public Service Health, Food chain Safety and Environment	Public official	http://www.health.belgium.be/eportal		Bram	Soenen	Scientific advisor	Belgium
67	BAM Federal Institute for Materials Research and Testing	Public official	www.bam.de	Dipl._Ing.	Judith	Gieseler	project manager	Germany
68	Nexans	EU manufacturer	www.nexans.com	Mr.	Friedrich	Mueller	Director Standardization	Germany
69	University of Bergamo	Researcher	www.unibg.it		Angelo	Baggini	professor	Italy

70	Compliance and Risks	Other	www.complianceandrisks.com	Ms	Michelle	Walsh	Lawyer	Belgium
71	Indesit	EU manufacturer	www.indesitcompany.eu	Ing	Francesca	Meloni	European Affairs Manager	Italy
72	Appliance Company, Panaonic Corporation	Other			Soji	Mori	Advisor	Japan
73	EEPCA	Other	eepca.eu		Valberto	Baggio	President	European Union
74	German Energy Agency	Public official	www.dena.de	Dr.	Karsten	Lindloff	Project Manager	Germany
75	VDE Testing and Certification Institute	Other			Christophe r	Jestädt	Projektmanager	Germany
76	Honda	EU manufacturer			João	Domingues	Governmental Relations - Regulations	Belgium
77	Compliance and Risks	Other	www.complianceandrisks.com	Ms	Michelle	Walsh	Lawyer	Belgium
78	SCHNEIDER ELECTRIC	Other	www.schneider-electric.com/		CARPENTI ER	Philippe	Standardisation and Regulation	FRANCE
79	ECOS	Environmental NGO	www.ecostandard.org		Chloe	Fayole	Ecodesign Policy Officer	Belgium
80	Nexans	EU manufacturer	www.nexans.com		sophie	Barbeau	SD technical manager	France
81	ICF International	Consultant	www.icfi.com	Mrs	Nina	Kaczmarcz yk	Senior Consultant	United Kingdom
82	Cenelec TC64 WG29	Other			Jacques	Peronnet	Convener	France
83	IGNES	Other	www.ignes.fr/	Mr	OLIVIER	HARRE	International Standardization expert	FRANCE
84	BAM Federal Institute for Materials Research	Public official			Daniel	Hinchliffe	Scientific Associate Ecodesign	Germany

	and Testing							
85	PCPM	Other		Energy Program Manager	Roman	Targosz	Energy project manager	Poland
86	PCPM	Other		Energy Manager	Roman	Targosz	Energy Project Manager	Poland
87	SCHNEIDER ELECTRIC	EU manufacturer	www.schneider-electric.com	M	Philippe	CARPENTI ER	Engineer	FRANCE
88	Europacable	Other			Annette	SCHERMER	Advisor HSE	Belgium
89	BASEC	Other	www.basec.org.uk	Dr	Jeremy	Hodge	Chief Executive	United Kingdom
90	The Cable Clinic Limited	Consultant	N/A	Mr	John	Ballingall	Managing Director	UK
91	EU Issue Tracker	Consultant			Dario	Annoscia	Senior Policy Analyst	Italy
92	Norwegian Building Authority	Public official	www.dibk.no	Mr	Martin	Strand	Head Engineer	Norway
93	EU Issue Tracker	Other			Dario	Annoscia	Senior Policy Analyst	Italy
94	European Environmental Bureau (EEB)	Environmental NGO	www.eeb.org		Carsten	Wachholz	Resource use and EU Product Policy officer	Belgium
95	ICF International	Consultant	http://www.icfi.com/	Ms	Theoni	Versi	Consultant	UK

ANNEX J PRESENTATIONS KICK-OFF MEETING ON 28TH JUNE 2013

18/02/2015

Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8- Power Cables

Kick-off meeting with stakeholders

Paul Van Tichelen

Brussels, DG Enterprise
28th of June 2013

Agenda

- » Study Team, tour de table
- » Introduction
- » MEErP in a nutshell
- » Planning
- » AOB

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EC policy officer & VITO Study Team

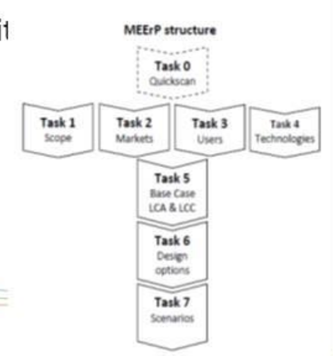
- EC policy officer: Cesar Santos
- VITO Preparotory Study Team:
  - Arnoud Lust: Contract Manager: Arnoud Lust (FC ENTR/29/PP/FC Lot 2) and FC DG ENER Lot 1
  - Main author power cables study&coordinator: Paul Van Tichelen
  - Co-authors:
    - Dominic Ectors (market and use data, ..)
    - Marcel Stevens (technical standards, ..)
    - Karolien Peeters (LCA, MEErP and scenarios, ..)
  - Administrative contacts:
    - Magalie Wellens +32 14 33 58 04
    - Katrien Bultynck +32 14 33 59 96
  - Website: Karel Styns (webmaster).

Introduction

- Background is the Ecodesign Directive 2009/125/EC:
  - Framework Directive
  - binding requirements through 'Implementing Measures' (EC Regulation ..)
  - For products but it is possible to introduce information requirements for components and sub-assemblies
  - Product groups are first identified in a Working Plan, such as power cables in the 2nd working plan year 2012-2014
  - A preparatory study provides the necessary information to prepare for the next phases in the policy process, a.o.: impact assessment, the consultation forum, ..)
  - Approach of preparatory study is well defined in the Methodology for the Ecodesign of Energy-related Products (MEErP)
  - Further info: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm

MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
- Task 1 - Scope (definitions, standards and legislation, first screening);
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
- Task 4 - Technologies (product supply side, includes both BAT and BNAT);
- Task 5 – Environment & Economics (Base case LCA & LCC);
- Task 6 – Design options;
- Task 7 – Scenarios (Policy, scenario, impact and sensitivit
- Tasks 1 to 4 can be performed in parallel



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Task 1 Scope

- **Identify relevant** Prodcom/ EN&ISO/ Labelling **categories > Stakeholder input!**
  - Define preliminary product scope, definition, primary ("functional unit"):
    - E.g.: power loss per meter (W/m) in day time load
  - Define secondary performance parameters:
    - E.g.: CSA, Conductor material(Cu, Al), Insulation, power factor, ..
- Test **standards**, also **under development > Stakeholder input!**
- Legislation, per country > **local grid codes or country specific installation codes .. > Stakeholder input!**
- First screening > Stakeholder input > see also working plan but will be updated (Eurocable input welcome)
- >Scope issue:
    - Indoor low voltage power cables (see working plan)
    - And/or Outdoor power cables (LV?, MV?, HV?)

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Task 2 Market Data

- Generic economic data (.. Eurostat?)
- Market and Stock data **> enquiry to stakeholders .. Compatible with categories & in task 4 'Base Cases', confidentiality & aggregation needed?**
- Market trends
- Consumer expenditure base data
- Recommendations (.. Scope, barriers&opportunities)

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Task 3 Users

- **System aspects:**
  - **ErP with direct**<> impact ErP with indirect impact<> ErP with direct + indirect impact
  - Indirect: internal heat gains in buildings or cooling..
  - **use phase energy consumption .. Cable losses**
  - .. will be very similar to transformers, e.g. impact power factor, harmonics, operational temperature&insulation, ... load profiles
- **End of Life behaviour**
- **Local infrastructure (barriers & opportunities),** e.g. cable bending
- Recommendations

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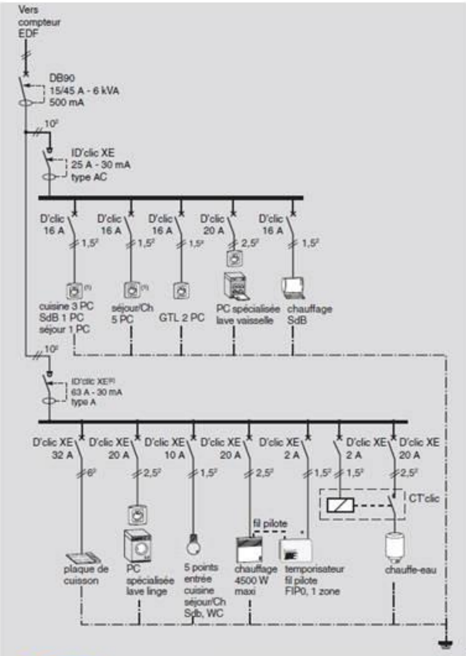
Country specific differences DIN vs AREI

France: La norme NF C 15-100 dans l'habitat



AREI: Belgium

Doorsnede van de geleider [mm²]	Nominale stroom van de smeltveiligheid	Nominale stroom van de automatische schakelaar
1,5	10 A	16 A
2,5	16 A	20 A
4	20 A	25 A
6	32 A	40 A
10	50 A	63 A
16	63 A	80 A
25	80 A	100 A
35	100 A	125 A

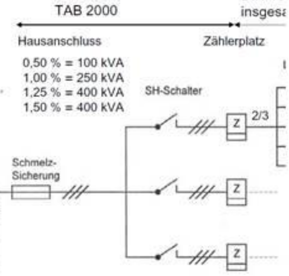
TEHALIT

525 Spannungsfall

Tabelle 2 – Maximal zulässige Kabel- und Leitungslängen l_{max} bei einem Spannungsfall von 3 %

Betriebs-strom A	Maximal zulässige … Leiterne… 1,5	2,5	4	6	10
6	92	150			
10	55	90	141		
16	34	56	88	132	
20	28	45	70	106	
25		36	56	85	142
35			40	60	101
40				53	89

DIN VDE 0100-520 insgesamt 4 %



- Drehstromkreise, Nennspannung der Anlage 400
- für Einphasen-Wechselstromkreise sind die Läng dem Faktor 0,5 zu multiplizieren.

Erstellt durch Abteilung Vfö J.Schwarz © Änderungen vorbehalten DIN VDE 100 520 Verkaufst

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Task 4 Technologies

- Technical product description
  - Existing products.. **Working towards 'Base Cases'** (=conscious abstraction of reality' ..has to fit with previous tasks & workable model)
  - Improvement options: **BAT&BNAT**
- **Production, distribution and end&of&life** > BOM > Ecoreport format&tool
- Recommendations

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Task 5-7

- **Task 5: Environment Economics**
  - Base Case Environmental Impact Assessment(EcoReport Tool)
  - Base Case Life Cycle Costs for consumer
  - Base Case Life Cycle Costs for society
  - EU wide impact
- **Task 6: Design options**
  - .. Identify LLCC & BAT > target levels & benchmark values
  - .. Long term potential& system analysis
- Task 7: Scenarios
  - Policy analysis

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Task 7 Scenarios

- Task 7: Scenarios
  - Policy analysis
  - Scenario analysis unit stock/sale & environmental
  - Impact analysis (socio) economic
  - Sensitivity Analysis
  - Summary

Note: MEErP 2011 is not an automatic law making procedure; the preparatory study is an analytical document at the responsibility of the contractor. Political and legislative choices, at the responsibility of the Commission, are indispensable in the follow up.

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Planning (preliminary)

- 28 Jun 2013 ■Project kick-off meeting with EC
- mid Jul 2013 ■Launch website www.erp4cables.net
- End Aug 2013 ■ Launch first series of enquiries to registered stakeholders
- End Nov 2013■ 1st stakeholder meeting on Draft Task 1-3
- End May 2014 ■ 2nd stakeholder meeting on Draft Task 1-5
- Early Nov 2014 ■ 3rd stakeholder meeting on Draft Task 1-7
- End Feb 2015 ■ Publication Final Report Task 1-7

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Questions & Conclusion

- CENELEC contact, Jens Erdmann?
- Scope:
  - Indoor low voltage cables?
  - Outdoor low voltage cables, medium voltage, high voltage?
- Stakeholder involvement, it is recommended to register at the website. Meeting participants will be registered automatically.
- Questions, AOB?

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ANNEX K PRESENTATIONS 1ST STAKEHOLDER MEETING ON 5TH DECEMBER 2013

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8- Power Cables

1st stakeholders

Paul Van Tichelen

Brussels, DG Enterprise
5th of December 2013

Agenda

» 10:00-10:10 Welcome
» 10:10-10:20 Short presentation of participants
» 10:20:-10:40 Introduction to MEErP and the ErP directive
» 10:40-12:00 Presentation of draft Task reports 1-3
» 12:00-12:15 Presentation of first screening
» 12:15-12:30 Enquiry results
» 12:30-13:30 Break&lunch
» 13:30-14:00 Discussion on scope
» 14:30-15:00 Answers to questions received in writing before the meeting
» 15:00-15:30 Other Q&A
» 15:30-16:00 Further needs for data provision and/or enquiries
» 16:00 Closure

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EC policy officer & VITO Study Team

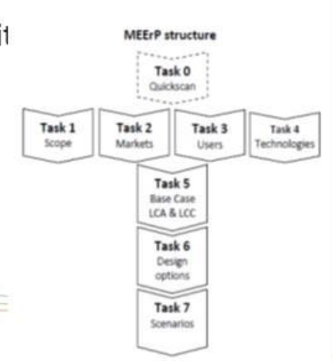
- EC policy officer: Cesar Santos
- VITO Preparotory Study Team:
  - Arnoud Lust: Contract Manager: Arnoud Lust (FC ENTR/29/PP/FC Lot 2) and FC DG ENER Lot 1
  - Main author power cables study&coordinator: Paul Van Tichelen
  - Co-authors:
    - Dominic Ectors (market and use data, ..)
    - Marcel Stevens (technical standards, ..)
    - Karolien Peeters (LCA, MEErP and scenarios, ..)
  - Administrative contacts:
    - Magalie Wellens +32 14 33 58 04
    - Katrien Bultynck +32 14 33 59 96
  - Website: Karel Styns (webmaster).

Introduction ErP Directive

- Background is the Ecodesign Directive 2009/125/EC:
  - Framework Directive
  - binding requirements through 'Implementing Measures' (EC Regulation ..)
  - For products but it is possible to introduce information requirements for components and sub-assemblies
  - Product groups are first identified in a Working Plan, such as power cables in the 2nd working plan year 2012-2014
  - **A preparatory study provides the necessary information to prepare for the next phases in the policy process, a.o.: impact assessment, the consultation forum, ..)**
  - Approach of preparatory study is well defined in the Methodology for the Ecodesign of Energy-related Products (MEErP)
  - Further info: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm

MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
- Task 1 - Scope (definitions, standards and legislation, first screening);
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
- Task 4 - Technologies (product supply side, includes both BAT and BNAT);
- Task 5 – Environment & Economics (Base case LCA & LCC);
- Task 6 – Design options;
- Task 7 – Scenarios (Policy, scenario, impact and sensitivit
- Tasks 1 to 4 can be performed in parallel



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Task 1 Scope

- **Identify relevant** Prodcom/ EN&ISO/ Labelling **categories > Stakeholder input!**
  - Define preliminary product scope, definition, primary ("functional unit“)
  - Define secondary performance parameters:
- Test **standards**, also **under development**
- Legislation
- First screening

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Task 2 Market Data

- Generic economic data (.. Eurostat?)
- Market and Stock data
- Market trends
- Consumer expenditure base data
- Recommendations (.. Scope, barriers&opportunities)

Task 3 Users

- **System aspects:**
  - **use phase energy consumption .. Cable losses**
- **End of Life behaviour**
- **Local infrastructure (barriers & opportunities)**
- Recommendations

Task 4 Technologies

- Technical product description
  - Existing products.. **Working towards 'Base Cases'** (=conscious abstraction of reality' ..has to fit with previous tasks & workable model)
  - Improvement options: **BAT&BNAT**
- **Production, distribution and end&of&life** > BOM > Ecoreport format&tool
- Recommendations

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Task 5-7

- **Task 5: Environment Economics**
  - Base Case Environmental Impact Assessment(EcoReport Tool)
  - Base Case Life Cycle Costs for consumer
  - Base Case Life Cycle Costs for society
  - EU wide impact
- **Task 6: Design options**
  - .. Identify LLCC & BAT > target levels & benchmark values
  - .. Long term potential& system analysis
- Task 7: Scenarios
  - Policy analysis

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Task 7 Scenarios

- Task 7: Scenarios
  - Policy analysis
  - Scenario analysis unit stock/sale & environmental
  - Impact analysis (socio) economic
  - Sensitivity Analysis
  - Summary

Note: MEErP 2011 is not an automatic law making procedure; the preparatory study is an analytical document at the responsibility of the contractor. Political and legislative choices, at the responsibility of the Commission, are indispensable in the follow up.

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Planning (preliminary)

- 28 Jun 2013 ■Project kick-off meeting with EC
- July 2013 ■Launch website www.erp4cables.net
- Aug 2013 ■ Launch first series of enquiries to registered stakeholders
- **5 dec 2013■ 1st stakeholder meeting on Draft Task 1-3**
- End May 2014 ■ 2nd stakeholder meeting on Draft Task 1-5
- Early Nov 2014 ■ 3rd stakeholder meeting on Draft Task 1-7
- End Feb 2015 ■ Publication Final Report Task 1-7

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 1

Paul Van Tichelen

Brussels, DG Enterprise
5th of December2013

MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
- **Task 1 - Scope (definitions, standards and legislation, first screening);**
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
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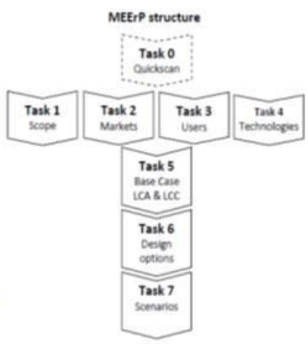

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Task 1: Content

- "Product scope" of the study
- Product categories based on
  - Prodcom
  - EN- or ISO-standards
  - Other product-specific categories
- Definitions & Terminolgy
- Primary & secondary product performance parameters
- Product Standards & Legislation
  - EU level
  - Member state level
- First screening

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Task 1: Product scope

- Focus: "Installed power cables & wires **in** buildings"
  - Buildings:
    - Residential
    - Non-residential: Services & Industry
  - Power cables behind the electrical meter
  - Fixed wired; LV ($\leq$ 1000Vac)
- Excluded:
  - HV, MV & LV distribution (utility) cables, overhead, burried...
  - Data cables, special purpose cables,...
  - Electrical distribution board, installation materials, socket outlets ...

- **SCOPE proposal: Losses in installed power cables & wires in buildings**

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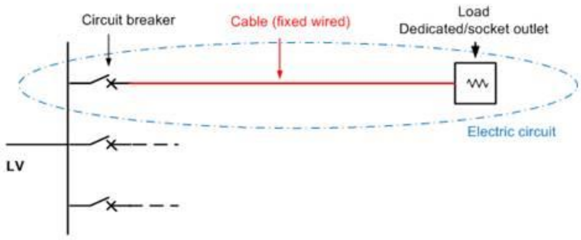
Task 1: Product scope

» **Electric circuit**



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Task 1: Product categories

- Prodcom – NACE 27321380:
  - "Other electric conductors, for a voltage ≤ 1000V, not fitted with connectors"
    - Too broad: cords, flexible wires,… also included
- EN-, IEC-standards:
  - IEC 60228: "conductors of insulated cables"
    - Class-1(solid), -2(stranded),-5(flexible),-6(very flexible)
  - IEC 60227-1: PVC cables – 5 categories
  - IEC 60245-1: Rubber insulated cables – 5 categories
  - ….
- Other possibilities: categories according to
  - Field of application, composition of the cable….

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Most used LV cables in buildings

To be completed + country designation code

Designation	NYM-J cable (VDE) 60227IEC10	H07 RN-F	H07 V-U H07 V-R	H05 V-K H07 V-K	FR-N05 VV-U FR-N05 VV-R
					
Use	For installation on or under the plaster In bricks and concrete	Protected mobile or fixed installation	Internal wiring or wiring fixed installation in trunking or conduit	Internal wiring or wiring fixed installation in trunking or conduit	Fixed installation on walls, empty construction compartments
Number of conductors	1 to 5	1 to 4	1	1	2 to 5
Conductor cross- section	2.5 to 25mm²	1.5 to 300mm²	Up to 400mm²	Up to 240mm²	1.5 to 6 mm²
Core	Strands of bare copper wires	Flexible copper	Rigid copper Solid (V-U) Stranded (V-R)	Flexible Copper	Rigid copper Solid (V-U) Stranded (V-R)
Insulation	PVC	Cross-linked elastomer	PVC	PVC	PVC
Sheath	PVC	Cross-linked elastomer	-	-	PVC
Nominal voltage	300/500V	450/750V	450/750V	H05: 300/500V H07: 450/750V	300/500V

Variants:
- **Low smoke, halogen free cables: e.g. H07 Z1-K, H07 ZZ-F,....**
- **Armoured cables: e.g. FG7(O)RAR 0.6/1 kV, U 1000 RVFV, ...**
- **Fire resistant cables: FTG100M1, SZ1-K,....**

Task 1: Product performance parameter

- Primary product performance paramater or "Functional unit":
  - **"Current-Carrying capacity" of the cable/conductor [Amperes]**
  - *"the maximum value of electric current which can be carried continuously by a conductor (a cable), under specified conditions without its steady-state temperature exceeding a specified value (see IEV 826-11-13)"*
- Secondary product performance parameters
  - Construction of the cable (see Task 2)
    - CSA, DC resistance, Rated voltage, insulation material, conductor material, number of cores, construction of the conductor....
  - Use of the cable (see Task 3)
    - Electrical installation: Supply param., installation method, Tamb...
    - Circuit level: dV, I load, I max, LF, Kf, PF, Kd.....

Task 1: Measurement & test standards

- Conductors & cables
  - EN13601 & -13602: Copper and copper alloys
  - **EN 60228**: Conductors of insulated cables
    - Class1,2,5,6; **Rdc max**; **measurement of resistance**, ...
  - EN 50525-1: Low voltage energy cables
  - EN 50395: Electrical test methods for low voltage energy cables
- Electrical installation
  - **HD 60364-5-52**: LV electrical installations – ... wiring systems
    - Correction factors, methods of installation, **dV max**, ...
  - IEC 60287-1-1: Calculation of current rating & losses -100% load factor
  - **IEC 60287-3-2**: Calculation of current rating – **Economic optimization** (segment)
  - IEC 60364-6: Low Voltage electrical installations - verification

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Measurement of resistance (IEC 60228)

"The cable shall be kept in the test area for sufficient time to ensure that the conductor temperature has reached a level which permits an accurate determination of resistance using the correction factors provided.

Measure the d.c. resistance of the conductor(s), either on a complete length of cable or flexible cord or on a sample of cable or flexible cord of at least 1 m in length, at room temperature and record the temperature at which the measurement is made. Adjust the measured resistance by means of the correction factors given in Table A.1.

Calculate the resistance per kilometre length of cable from the length of the complete cable and not from the length of the individual core or wires"

Accuracy of the measurement equipment?

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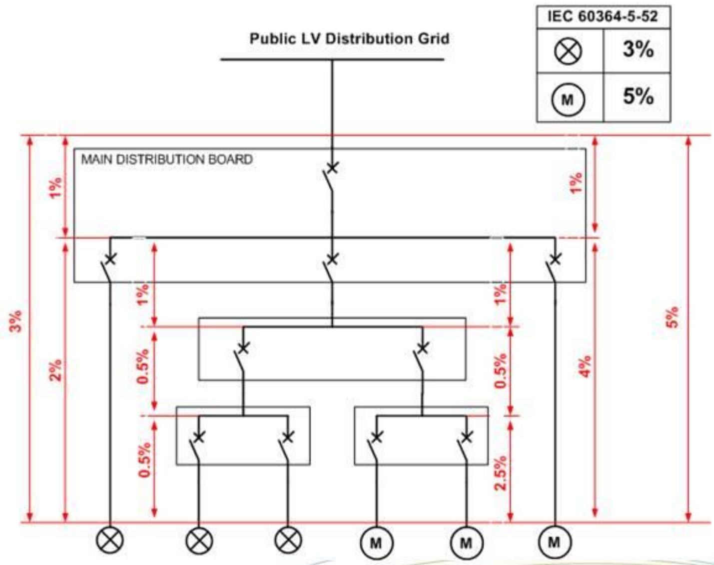
Max voltage drop (IEC 60364-5-52)



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Legislation

- EU Directives applicable on LV cables
  - Low Voltage Directive (LVD, 2006/95/EC)
  - Restriction of Hazardous Substances in EEE (RoHs, 2002/95/EC)

  Conclusion: “**CE** “ and/or “**HAR**” mark on the cable (see LVD guide)
  - Construction Products Regulation (EU) No 305/2011 (CPR)

    The publication of the standard for power cables and control and communication cables – cables for general applications in buildings with regard to the demands made on fire behaviour is not expected before 2014 (ZVEI)
  - **Other Directives applicable ??**
- Member state level
  - National wiring regulation rules
  - **Overview of national wiring regulations available ??**
- **Third country legislation ??**
- Voluntary initiatives: e.g. ELEKTRO+ (Ge), ACI (UK), **other ??**

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Task 1: First screening

Insulation materials (I)

- Most used insulation materials voor electric cables & wires:

Type	Name	Tmax oper.
PVC	Polyvinyl Chloride	70°C
XLPE	Cross-Linked PolyEthylene	90°C
EPR	Ethylene Propylene Rubber	90°C

- Low Smoke Halogen free insulation materials
  - Based on Thermoplastic Elastomeren (TPE) compounds (e.g. PE, PP)
  - Compliant to:
    - IEC 60754-1: Amount of halogen acid gas
    - IEC 60754-2: Degree of acidity of gases
    - IEC 61034-2: Smoke density

Insulation materials (II)

- Flame retardant wires /cables:
  - Single wire: Compliant to IEC 60332-1/2
  - Bundled cables: Compliant to IEC 60332-3
- Fire resitant cable:
  - Compliant to IEC 60331-21 (Uo/U≤0,6/1 kV)

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task1 first screening

Dominic Ectors

Brussels, DG Enterprise
5th of December2013

Objective

» The first product screening is a **preliminary analysis** that sets out the recommended scope for the subsequent Tasks. As the full study investigates the feasibility and appropriateness of Ecodesign and/or Energy Labelling measures, the first product screening entails an **initial assessment of the eligibility and appropriateness of the product group envisaged.**

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Product application categories

Table 1-3: Application categories

	Sector	Residential			Services			Industry		
Circuit level 1	Application category id	1			2			3		
Circuit level 2	type of application	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit
	Application category id	4	5	6	7	8	9	10	11	12

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Preliminary analysis according to Working plan

Market and stock data for the first screening

Table 1-4: Sales of power cables (kTon Copper)

Annual Sales (kTons eq. Copper)	2000	2005	2010	2015	2020	2025	2030
Industry	226	245	241	253	266	279	293
Services	202	219	216	227	238	250	263
Residential	284	308	303	318	334	351	368
Total	712	772	760	798	838	880	924

Table 1-5: Stock of power cables (kTon of Copper)

Stock (kTons eq. Copper)	2000	2005	2010	2015	2020	2025	2030
Industry	5991	6102	6538	6951	7395	7453	7511
Services	4338	4419	4734	5033	5355	5397	5439
Residential	6886	7014	7515	7989	8500	8567	8633
Total	17215	17536	18788	19974	21250	21417	21583

Assumptions were:
30 kg of equivalent copper per electrical installation of a household.
Stock in non-residential buildings = 1.5 times the stock in residential buildings (based on copper wire and cable consumption statistics).

Cable loading data and loss

Table 1-6: Final affected energy demand, related to power cables[1]

FINAL ENERGY DEMAND - Reference Scenario	Unit	2010	2015	2020	2025	2030
Industry	TWh	1073	1152	1207	1279	1329
Services	TWh	775	832	872	924	960
Residential	TWh	950	1021	1069	1133	1177
Total Electricity	TWh	**2798**	**3005**	**3148**	**3336**	**3466**
Total Electricity	PJelec	10074	10818	11334	12011	12478
Total energy	PJ prim	25182	27045	28332	30024	31194

The calculated averaged energy loss in power cables for the sectors defined in the EGEMIN study was **2.04%.**

[1]Based upon projections made by EC regarding energy consumption in buildings

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Review of losses

Loss ratio = $\frac{\text{energy losses in the circuit cables}}{\textit{energy transported by those circuits}}$

- Residential model: **less than 0.3%** (loss ratio on Iavg : 0.15%)
- Services model: **2.26%** (loss ratio on Iavg: 1.83%)
- Industry:
  - Assumptions: design based upon maximum voltage drop
    - 3% (6%) for lighting circuits, 5 % (8%) for other circuits, when supplied from public (private) voltage distribution (see Table 1-15).
    - high load factor;
    - dedicated circuits with a high distribution factor :
  - loss ratio between 1% and 8%.

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Residential model

- Load factor α_c =Pavg/S (S: rated power circuit)
- Load Form factor Kf = Prms/Pavg
- 3500kWh -> 400 W -> 1.74 A (230V)
- 25 Kg Cu/100 m² (flat, 84 m²)

Table 1-7: Residential model: parameters and calculated losses

Summary	Circuits					Installation
	RESL1	RESL2L	RESL2S	RESL2D	RESL2D	
Total circuit length (m)	30	34	40	17	17	
CSA (mm²)	10	1.5	2.5	2.5	6	
Loaded cores	3	2	2	2	2	
Kd (distribution factor)	1.00	0.50	0.50	1.00	1.00	
α (load factor= Pavg/S)	0.03	0.01	0.02	0.01	0.01	
Kf (load form factor)	1.08	1.29	2.83	6.48	4.90	
PF (power factor)	0.90	0.90	0.90	0.90	0.90	
loss ratio on Imax (formula 3.5)	0.15%	0.02%	0.09%	0.21%	0.06%	0.24%
loss ratio on Iavg (formula 3.1)	0.12%	0.02%	0.03%	0.03%	0.01%	0.15%

Improvement potential by increasing CSA

Table 1-9: Impact on energy losses and copper usage (working plan)

Strategy	Energy loss	Loss reduction	Cu weight	Additional Cu
Base	2.04%	0.00%	100.0%	0.0%
S+1	1.42%	0.62%	141.6%	41.6%
S+2	1.02%	1.02%	197.7%	97.7%
Economic	0.75%	1.30%	274.2%	174.2%
Carbon	0.29%	1.76%	907.3%	807.3%

Table 1-10: Improvement scenario power cables (working plan)

Potential savings (starting measures in 2013)	Unit	2010	2015	2020	2025	2030
annual rate (refurbishment)		3%				
Stock of buildings - old standard installations		100%	100%	85%	70%	55%
Stock of buildings - new standard installations		0%	0%	15%	30%	45%
Improvement scenario - final energy consumption	PJprim/year	25182	27045	28277	29907	31012
Savings	PJprim/year	0	0	55	117	182
Total electricity savings	TWh/year	0	0	6	13	20

Review improvement potential

Table 1-11 S+x scenario overview based upon CSA ratio

CSA	resistance reduction based upon CSA ratio (S+x)/S				
mm^2	S+1	S+2	S+3	S+4	S+5
Minimum	17%	33%	48%	58%	67%
Maximum	40%	63%	76%	85%	91%
Average	27%	47%	61%	71%	78%
Average for CSA 1,5 till CSA 10	38%	61%	74%	83%	89%
Average for CSA 1,5 till CSA 25	36%	58%	72%	81%	86%

A reduction in losses from 2.04% to 0.75% (reduction of 1,3%) implies a resistance reduction of 63%. A scenario consisting of a combination of S+2 and S+3 strategies corresponds with such a resistance reduction.

Dual wiring: reducing the load by means of cables in parallel

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Significant environmental impact & potential for improvement

Table 1-12: Overview annual savings in 2030

		Unit	Residential sector	Services sector	Industry sector	Total	Total without residential sector
Energy consumption		TWh/y	1177	960	1329	3466.00	2289
Loss ratio		%	0.3%	2.0%	2.0%		
Losses		TWh/y	3,531	19.2	26.58	49.31	45.78
Improvement scenario penetration in 2030		%	45%	45%	45%		
S+1 strategy minimum savings	17%	TWh/y	0.27	1.47	2.03	3.77	3.50
S+1 strategy maximum savings	40%	TWh/y	0.64	3.46	4.78	8.88	8.24
S+2 strategy minimum savings	33%	TWh/y	0.52	2.85	3.95	7.32	6.80
S+2 strategy maximum savings	63%	TWh/y	1.00	5.44	7.54	13.98	12.98

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Conclusion

- Significant environmental impact : yearly losses of **45.78 TWh/y**
  - with residential buildings: 49.31 TWh/y
- Significant potential for improvement: **S+1: min 3.5 TWh/y – 8.24 TWh/y**
  - with residential buildings: 3.77 TWh/y – 8.88 TWh/y
- Significant potential for improvement: **S+2: min 6.8 TWh/y – 12.98 TWh/y**
  - with residential buildings: 7.32TWh/y – 13.98 TWh/y
- significant trade and sales volume:
  - ProdCom (includes more than LV power cable): in 2012 for the EU28 a production of 2128 kTon and a production value of 12300 million Euro. (divide by 3 = about 776 kTon working plan ?)
- Proposal: **to exclude residential buildings from study**

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 2

Paul Van Tichelen

Brussels, DG Enterprise
5th of December2013

MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
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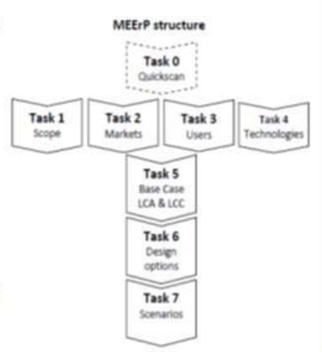

Content

- **2.1 Generic economic data**
- **2.2 Market and stock data**
  - **2.2.1 Sales data**
  - **2.2.2 Stock data**
- **2.3 Market trends**
- **2.4 Consumer expenditure base data**
- **2.5 Recommendations**

ProdCom data

Table 2-1: ProdCom data relevant NACE code

Prodcom Nace code	Description
27321380	Other electric conductors, for a voltage <= 1000 V, not fitted with connectors

Note: The ProdCom data include a broad range of electrical wires and cables, such as wires and cables for electrical installations inside and outside the buildings (e.g. LV distribution cables), wires and cables for data communication (coax cables are excluded), flexible cords, wires for internal wiring of control panels, instrumentation cables, elevator cable, and others. The category includes cables and wires with conductors made of copper, aluminium or any other material.

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ProdCom data

Table 2-2: EU27 ProdCom data on NACE code 27321380

Year	Quantity in kTon				Value in million €			
	Production	Import	Export	Apparent EU consumption	Production	Import	Export	Apparent EU consumption
2007	1550				9300			
2008	2171				11648			
2009	1920				8400			
2010	2200				11100			
2011	2280				12600			
2012	2128				12300			

Table 2-3: Value per kg conductor based on ProdCom data (NACE code 27321380)

Year	Value in 1000 €	Quantity in Ton	€/kg
2007	9300000	1550000	6.00
2008	11647510	2171223	5.36
2009	8400000	1920000	4.38
2010	11100000	2200000	5.05
2011	12600000	2280000	5.53
2012	12300000	2128632	5.78
Average			**5.35**

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Sales data from EU cable industry associations

- To verify the ProdCom data with recent data from stakeholders a questionnaire was sent to the cable manufacturers.
- **Extra responses are needed to** guarantee anonymity, stakeholders are still invited to use the enquiry form and to reply.

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Sales of power cables in Europe according to working plan

Table 2-4: Sales of power cables (kTon Copper)

Annual Sales (kTons eq. Copper)	2000	2005	2010	2015	2020	2025	2030
Industry	226	245	241	253	266	279	293
Services	202	219	216	227	238	250	263
Residential	284	308	303	318	334	351	368
Total	712	772	760	798	838	880	924

Table 2 4 shows that annual sales of wiring, expressed as kilotons equivalent copper, is estimated to be some **760 kton in 2010**, and expected to increase to **924 kton in 2030**

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CRU Wire and Cable Quarterly report

Table 2-5: kTons of conductor for Europe 2013f (source: CRU Wire and Cable Quarterly, Q3 2013)

000 tons conductor content by region (2013f)

Europe	Cu	Al
Bare Overhead Conductors	0	306
Insulated Cables	1828	531
Winding Wire	424	38
Subtotal	**2252**	**874**

Table 2-6: European consumption of wire & cable by type ('000 ton conductor independent of metal, 2013f) (source: CRU Wire and Cable Quarterly, Q3 2013)

Europe	
LV Energy	1073
Power Cable	1114
External Telecom	68
Internal/Data	218
Winding Wire	465
Sub-Total	**2938**

- LV Energy: all cable whose primary function is the transmission of energy and rated at below 1kVac;
- *Sales: 1073/3*4=1430kTon (Cu+Al, whole Europe, also LV distribution)* versus about 2200 kTon (EU27, ProdCom) *versus about 783 kTon copper WP (EU,2013)*

Stock data according to working plan

Table 2-7: Total amount of copper installed in buildings

Stock (kTons eq. Copper)	2000	2005	2010	2015	2020	2025	2030
Industry	5991	6102	6538	6951	7395	7453	7511
Services	4338	4419	4734	5033	5355	5397	5439
Residential	6886	7014	7515	7989	8500	8567	8633
Total	17215	17536	18788	19974	21250	21417	21583

760kTon sales /18788 kTon stock = about 4% (new + replacement)
'replacement sales (rennovation)' > 25 years (1/0,04)??

Stock

- Power cable stock = building stock floor area x kg cable/m²
- Buildings (BPIE):
  - **24 billion m²** of useful floor space (industry floor space excluded?)
  - The residential stock : 75% of the building stock: 18 billion
- Buildings (Ecofys study):
  - non-residential building stock: 12.3566 – 13.2906 billion m²
  - industry building stock: 2.752 billion m²
- **29 – 139 kg/100m² depending on sector** (based upon CuIoU survey)
- Results in
  - Residential buildings: 5241 kTon versus 7515 kTon in working plan
  - Services buildings: 3250 kTon versus 4734 kTon in working plan
  - Industry buildings: 3825 kTon versus 6538 kTon in working plan

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Example of office building

Table 2-14: Example of an real office building

Amount of Ligth circuits	33
Amount of Socket outlet circuits	62
Amount of Dedicated circuits	34
Amount of Main feeders	1
Amount of Sub feeders	11
Cu total (kg)	2851
Floorspace (m²)	3059
Cu (kg/100m²)	93

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Distribution of power cables based upon CSA residential buildings

Table 2-15: Distribution of LV cables in the residential buildings[1]

CSA (mm²)	% Weight	% Length
1.5	23.4	27.5
2.5	38.9	40
4	6,6	4.9
6	9,3	5.7
10	6.1	<1

The total length of 1.5 +2.5 mm² cables counts for 67.5% of the total length of the installed cables in the residential sector.

[1] Source: CuIoU survey European Copper Institute

Distribution of power cables based upon CSA non-residential buildings

Table 2-16: Distribution of LV cables in non-residential buildings[1]

CSA (mm²)	% Weight	% Length
1.5	2	15
2.5	13	58.6
4	2	4.9
6	3	5.1
10	3	3.2
16	3	2.4
25	4	2
35	6	1.9
50	5	1.2
70	11	1.8
95	12	1.4
120	9	0.9
150	6	0.4
185	13	0.8
240	7	0.4
300	0	0
400	3	0.1
500	0	0
600	0	0

The total length of 1.5 +2.5 mm² cables counts for 73.6% of the total length of the installed cables in the non-residential sector.

[1] Source: CuIoU survey European Copper Institute

Sales rate and stock data summary

Table 2-18: Summary of growth rates

Sector	New Sales growth rate	Replacement sales growth rate
Residential	1% (BPIE)	0.59% (Heinze+BPIE)
Services	2.1% (Ecofys)	7.08% (Heinze+Ecofys)
Industry	3.1% (Ecofys)	7.08% (Heinze+Ecofys)

Table 2-19: Summary of stock data

Sector	Building floor area	Amount of Cu material per 100m² empirical
Unit	Million m²	kg/100m²
Residential	18000	29.1
Services	6000	54
Industry	2752	139

Source: BPIE, Ecofys study, Heinze study,

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Market trends

- Power cables are a **mature** product and available in standardized sizes.
- There is a trend to use low smoke halogen free cables in buildings?

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Product cost

- Product unit is (CSA [mm^2] x l [m] x N).
- Product cost
  - Average user price (2013) around **0.075 €/ (mm^2x m x 1 core)**.
  - Average (2005-2010) factory price (ProdCom) around **0.047 €/ mm^2 x m**.

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Other costs

- **Installation costs**
  - **Stakeholders are invited to provide input on an approach, e.g. labour hours per m and labour cost per hour? Per mm^2 & m? In hours labour.**
- **Repair and Maintenance costs**
  - No repair, nor maintenance costs
- **Disposal costs/benefits**
  - The positive scrap value for the owner of the cable should be about 70% of the copper price.

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 2

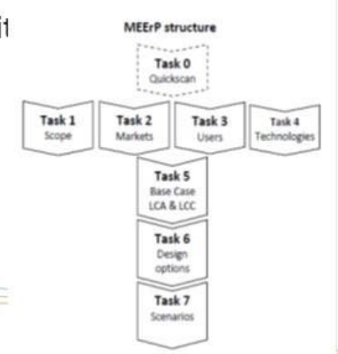
Paul Van Tichelen

Brussels, DG Enterprise

5th of December2013

MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
- Task 1 - Scope (definitions, standards and legislation, first screening);
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
- Task 4 - Technologies (product supply side, includes both BAT and BNAT);
- Task 5 – Environment & Economics (Base case LCA & LCC);
- Task 6 – Design options;
- Task 7 – Scenarios (Policy, scenario, impact and sensitivit
- Tasks 1 to 4 can be performed in parallel



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Task 3 Users

- **Systems aspects of the use phase for ErPs with direct impact**
  - Definition of the User and context
  - Loss parameters directly related to the cable itself
  - Other functional cable parameters not directly related to losses
  - Loss parameters directly related to the electrical circuit and network topology
  - Parameters related to the building and loading
  - Formulas used for power losses in cables
- **Systems aspects of the use phase for ErPs with indirect impact**
- **End of Life behaviour**
- Local infrastructure (barriers & opportunities), e.g. cable bending
- Recommendations

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Product to systems approach

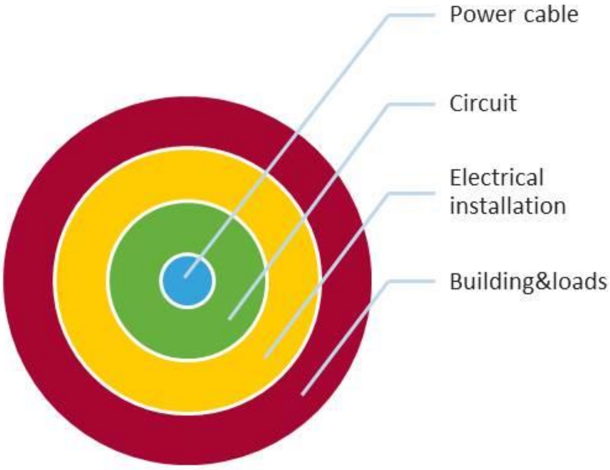

Figure 3-1: From strict product to systems approach

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Loss parameters directly related to the cable itself

» R= ρ_t.l/A (Ohm) (formula 3.2)

» 3.1.2.1 Conductor material electrical resistance
» 3.1.2.2 **Cross-sectional area (CSA)**
» 3.1.2.3 Length of cable
» 3.1.2.4 Number of cores
» 3.1.2.5 Skin effect

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CSA per circuit application type & sector

Table 3-2: Typical cable cross sectional areas depending on the circuit type

Sector	Circuit application type	CSA (mm^2) min	CSA (mm^2) ref	CSA (mm^2) max
Residential	Distribution circuit	2.5	10	16
	Lighting circuit	1	1.5	2.5
	Socket-outlet circuit	1.5	2.5	6
	Dedicated circuit	2.5	4	6
Services	Distribution circuit	10	35	600
	Lighting circuit	1.5	1.5	2.5
	Socket-outlet circuit	1.5	2.5	6
	Dedicated circuit	2.5	35	95
Industry	Distribution circuit	25	95	600
	Lighting circuit	1.5	1.5	2.5
	Socket-outlet circuit	1.5	2.5	10
	Dedicated circuit	2.5	35	600

Own estimates
New input from stakeholder, not processed yet.

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Other functional cable parameters not directly related to losses

- **Insulation material**
- Construction of the conductor

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Insulation material

- The selection criteria of insulation material depends on electrical (rated voltage) and physical (temperature range, flexibility, flammability, chemical resistance,....) requirements of the application.
- The selection of insulation material is also influenced by building properties and function of the building (risk of fire, evacuation capability,..).

- **Conclusion:**
  - **To be decided whether this is relevant or not**.

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Loss parameters directly related to the electrical circuit and network topology

- 3.1.4.1 Single phase or three phase circuit
- 3.1.4.2 Maximum voltage drop in a circuit
- 3.1.4.3 Overcurrent protection in a circuit
- 3.1.4.4 Circuit network topology
- 3.1.4.5 **Circuit length**
- 3.1.4.6 **Effect of load distribution**
- 3.1.4.7 **Effect of not simultaneous functioning of distributed loads**
- 3.1.4.8 Ambient temperature
- 3.1.4.9 Temperature effect caused by the 'method of installation'
- 3.1.4.10 Single or three phase system
- 3.1.4.11 Number of distribution levels
- 3.1.4.12 Rated Diversity Factor DF at installation level

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Circuit length

- Based upon enquiry, but corrected (factor 1. 2 for branches in lighting circuits)

Table 3-6: Corrected (and rounded) average circuit length in meters

Sector	Circuit application type	Average length min (m)	Average length ref (m)	Average length max(m)
Residential	Distribution circuit	5	17	40
	Lighting circuit	12	21	3
	Socket-outlet circuit	5	20	50
	Dedicated circuit	5	17	40
Services	Distribution circuit	10	34	80
	Lighting circuit	14	38	72
	Socket-outlet circuit	10	31	65
	Dedicated circuit	10	34	80
Industry	Distribution circuit	15	72	200
	Lighting circuit	24	65	120
	Socket-outlet circuit	15	48	100
	Dedicated circuit	15	72	200

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Effect of load distribution

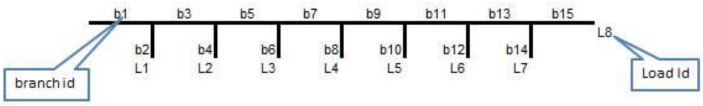

Table 3-7: Kd factors for circuits with minimum 1 to maximum 8 socket-outlets with equally distributed loads and cable segment lengths

	Number of socket-outlet							
	1	2	3	4	5	6	7	8
Kd	1	0,61	0,50	0,45	0,42	0,40	0,39	0,38

Table 3-9: Kd factor per circuit type

Sector	Circuit application type	Kd min	Kd avg	Kd max
Residential	Distribution circuit		1	
	Lighting circuit	0.38	0.5	1
	Socket-outlet circuit	0.38	0.5	0.9
	Dedicated circuit		1	
Services	Distribution circuit		1	
	Lighting circuit	0.38	0.5	1
	Socket-outlet circuit	0.38	0.5	0.9
	Dedicated circuit		1	
Industry	Distribution circuit		1	
	Lighting circuit	0.38	0.5	1
	Socket-outlet circuit	0.38	0.5	0.9
	Dedicated circuit		1	

Parameters related to the building and loading

- 3.1.5.1 **Load Factor (αc) and load form factor (Kf)**
- 3.1.5.2 **Power factor**
- 3.1.5.3 Impact of harmonics
- 3.1.5.4 Number of loaded conductors and impact of phase imbalance and harmonics

Load factors (αc) and load form factors (Kf)

- Load factor α_c =Pavg/S (S: rated power circuit)
- Load Form factor Kf = Prms/Pavg

Table 3-12: Load form factor and load factors in the services sector

Services												
	Lighting circuit			Socket-outlet circuit			Dedicated circuit			Distribution circuit		
	Low	Ref	High	Low	Ref	High	Low	Ref	High	Low	Ref	High
Use factor	0.4	0.5	0.7	0.2	0.3	0.4	0.6	0.7	0.8	0.6	0.7	0.8
P2/P1 ratio	10%	20%	30%	10%	20%	30%	10%	20%	30%	10%	20%	30%
P1 (amplitude)	100	100	100	100	100	100	100	100	100	100	100	100
Period 1 (time)	50	60	70	50	60	70	70	80	90	70	80	90
P2 (amplitude)	10	20	30	10	20	30	10	20	30	10	20	30
Period 2 (time)	118	108	98	118	108	98	98	88	78	98	88	78
Period 1 + Period 2	168	168	168	168	168	168	168	168	168	168	168	168
Prms	55	62	68	55	62	68	65	71	76	65	71	76
Pavg	37	49	59	37	49	59	48	58	68	48	58	68
Kf	1.50	1.27	1.16	1.50	1.27	1.16	1.37	1.21	1.13	1.37	1.21	1.13
α_c	0.15	0.24	0.41	0.07	0.15	0.24	0.29	0.41	0.54	0.29	0.41	0.54
Kf . α_c	0.22	0.31	0.48	0.11	0.19	0.27	0.39	0.49	0.61	0.39	0.49	0.61

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Load factors (αc) and load form factors (Kf)

Table 3-14: Load factors (α_c) and load form factors (Kf) to be used in this study

		Lighting circuit			Socket-outlet circuit			Dedicated circuit			Distribution circuit		
		Low	Ref	High	Low	Ref	High	Low	Ref	High	Low	Ref	High
Residential sector	Kf	3.12	2.11	1.67	4.38	1.74	1.34	4.61	3.99	3.12	1.24	1.14	1.08
	α_c	0.02	0.05	0.10	0.00	0.04	0.10	0.01	0.02	0.05	0.03	0.06	0.22
	Kf . α_c	0.06	0.11	0.17	0.02	0.06	0.13	0.05	0.08	0.14	0.03	0.07	0.23
Services sector	Kf	1.50	1.27	1.16	1.50	1.27	1.16	1.37	1.21	1.13	1.37	1.21	1.13
	α_c	0.15	0.24	0.41	0.07	0.15	0.24	0.29	0.41	0.54	0.29	0.41	0.54
	Kf . α_c	0.22	0.31	0.48	0.11	0.19	0.27	0.39	0.49	0.61	0.39	0.49	0.61
Industry sector	Kf	1.11	1.06	1.03	1.11	1.06	1.03	1.03	1.01	1.00	1.05	1.02	1.01
	α_c	0.23	0.34	0.54	0.12	0.27	0.46	0.46	0.61	0.76	0.46	0.61	0.76
	Kf . α_c	0.26	0.36	0.55	0.13	0.29	0.47	0.47	0.61	0.76	0.47	0.61	0.76

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Power factor

- **Power factor**
  - Although the power factor will differ from circuit to circuit depending on the load type, it is proposed to use **PF = 0.9** when load profiles are used.

Formula 3.2 used for power losses in cables

$$R_t = \rho_t . l/A\ (\Omega) \qquad \text{(formula 3.2)}$$

where,

- ρ_t= specific electrical resistance of the conductor at temperature t ($\Omega.mm^2/m$)
- l= length of the cable (meter)
  - **Length = circuit length x number of loaded conductors (2 or 3)**
- A= cross sectional area of the conductor (mm^2)
- ρ_t is the resistivity of conductors in normal service, taken equal to the resistivity at the temperature in normal service, i.e. **1,25 times** the resistivity at 20 °C, or 0,0225 $\Omega mm^2/m$ for copper and 0,036 $\Omega mm^2/m$ for aluminium; IEC 60364-5-52 annex G

Formula 3.5 used for power losses in cables

$E_{circuit}(y)$ [kWh] = Kd x R_t x $Imax^2 \times (\alpha_c \times Kf/PF)^2 \times 8760 / 1000$ (formula 3.5)

where,

- Kd = the distribution factor
- R_t = cable resistance at temperature t (see formula 3.2)
- Imax = the maximum rated current of the cable
- α_c = The **corrected** load factor
- Kf = Load form factor (=Prms/Pavg)
- PF = the power factor of the load served by the power cable

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Systems aspects of the use phase for ErPs with indirect impact

- **Building space heating and cooling system**
  - Cable losses are dissipated in the form of heat energy and therefore contribute to so-called 'internal heat gains', this has and impact on the building heating and cooling requirements. The impact can be positive when heating is needed or negative when cooling is needed.

- **Conclusion:** because the impact can be positive or negative and it is not the primary function of the cable to contribute to the heating it is proposed to further **neglect** this effect in the study.

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End-of-Life behaviour

- Assumptions made in this study (Stakeholders please provide input):
- Present fractions to recycling, re-use and disposal for copper:
  - **95%?, 0%, 5%?**
- Present fractions to recycling, re-use and disposal for aluminium:
  - **95%?, 0%, 5%?**
- Present fractions to recycling, re-use and disposal for insulation:
  - **50%?, 0%, 50%?**
- Present fraction of second hand use and refurbishment: **0%**
- Product use & stock life: **40 years?**
- Repair & maintenance practice: **not existing**
- Collection rate: **95 %?**
- Second hand use: **not existing**

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: questionnaire

Dominic Ectors

Brussels, DG Enterprise
5th of December2013

Questionnaire for installers

- http://www.erp4cables.net/node/6,
- questionnaire was sent to installers on the 30th of September, 2013 in the context of this study.
- 8 responses

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1. Amount of nodes

- On average how many nodes/points (socket-outlet, light fixture, fixed connection,...) are there on an electric circuit (circuit after a circuit breaker) ?

Table 3-8: Average number of nodes per circuit application type

Sector	Circuit application type	Average number min (m)	Average number ref (m)	Average number max(m)
Residential	Distribution circuit			
	Lighting circuit	5	10.7	30
	Socket-outlet circuit	8	10.3	20
	Dedicated circuit	1	2	3
Services	Distribution circuit			
	Lighting circuit	6	13.8	25
	Socket-outlet circuit	5	6.6	8
	Dedicated circuit	1	2.2	5
Industry	Distribution circuit			
	Lighting circuit	4	14.6	28
	Socket-outlet circuit	2	5.7	18
	Dedicated circuit	1	1.9	5

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2. Circuit length

Please estimate the average length of an electric circuit per sector?

Table 3-6: average circuit length in meters

Sector	Circuit application type	Average length min (m)	Average length ref (m)	Average length max(m)
Residential	Distribution circuit			
	Lighting circuit	10	18	30
	Socket-outlet circuit	5	20	50
	Dedicated circuit	5	17	40
Services	Distribution circuit			
	Lighting circuit	12	31	60
	Socket-outlet circuit	10	31	65
	Dedicated circuit	10	34	80
Industry	Distribution circuit			
	Lighting circuit	20	54	100
	Socket-outlet circuit	15	48	100
	Dedicated circuit	15	72	200

3. Aluminium inside buildings

- Do you use aluminium power cables for electrical installations inside buildings?
- Answers:
  - 5 x No, 3 x Yes
  - Comments:
    - Due to cost and practical reasons aluminium cables are often used in main circuits and also in consumer circuits with a significant load (> 32 A).
    - rarely, only large amperages over large distances

4. Designed by means of a calculation tool

» How many electrical installations, performed by your company, are designed by means of a maximum voltage drop and safety requirement calculation. Please indicate roughly in percentage (0 %, 25% , 50 %, 75% or 100 %).

	Residential	Services	Industry
No calculation	11%	5%	1%
Design based on rules of thumb or predefined tables	42%	26%	12%
Design calculated by means of software tool, taking into account voltage drop and safety requirements	46%	69%	88%

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5. Energy losses estimation

» Do you think there are significant energy losses in low voltage power cables in indoor electrical installations? (<1 %, 1-3 %, > 3 %)

» Answers:
  - » 1-3%: 6
  - » 3% :2

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6.Installation

- Who may perform an electrical installation in your country?
- Answers:
  - In the residential sector?
    - Anyone (no qualification): 1 (UK)
    - Qualified person/organisation: 7
    - No idea: 0
  - In the non-residential sector?
    - Anyone (no qualification): 0
    - Qualified person/organisation: 8
    - No idea: 0

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7.Certification

- Must an electrical installation be certified in your country?
- Answers:
  - In the residential sector?
    - Yes: 7
    - No: 1 (Norway)
  - In the non-residential sector?
    - Yes: 7
    - No: 1 (Norway)

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8. Certifier

- Who may certify an electrical installation in your country? Only to be filled in when certification is obligatory.
- Answers
  - Anyone: 0
  - Qualified installer: 6 (5)
  - Independent (accredited) company: 2

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9. National wiring code

- Please indicate the installation/national wiring code or standard used for electrical installations in your country?

- See Task 1: table 1-18

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10. BMS

- Please indicate relatively (in percentage) per sector how many installations performed by your company include a home/building management system (BMS) or building automations and control system (BACS)?

	Residential	Services	Industry
Percentage of installations having a BMS or BACS	12%	54%	60%

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Questionnaire for cable manufacturers

- questionnaire was sent to installers on the 30th of September, 2013 in the context of this study.
- Two questions:
  - 1. Indicate the annual EU27 (27 member states of European union in 2010) of sales for the year 2010 of power cables per cross cable section (CSA) and per number of cores. Please express in **kilometer** cable.
  - 2. Highlight the countries that are part of your market; which cable labelling standard is used in these countries; and the installation code/national wiring code for indoor installations (e.g. AREI code for Belgium, NFC 15-100 for France, ...)
- 2 responses
  - Too low to guarantee anonymity

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ANNEX L PRESENTATIONS 2ND STAKEHOLDER MEETING ON 3RD JUNE 2014

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8- Power Cables

2nd stakeholder meeting

Paul Van Tichelen

Brussels, DG Enterprise
3rd of June 2014

Agenda

» 10:00-10:10 Welcome
» 10:10-10:20 Short presentation of participants
» 10:20:-10:30 Short overview MEErP
» 10:30-13:00 Presentation of draft Task reports 1-5, including: updates, questions & answers, discussion
» 13:00-14:00 Break &lunch
» 14:00-14:30 Data gaps identified to complete the study
» 14:30-15:15 Discussion on approach to fill data gaps and the potential launch of a new enquiry
» 15:15-15:30 Any other business
» 15:30 -15:45 Planning and Closure

EC policy officer & VITO Study Team

- EC policy officer: Cesar Santos
- VITO Preparotory Study Team:
  - Arnoud Lust: Contract Manager: Arnoud Lust (FC ENTR/29/PP/FC Lot 2) and FC DG ENER Lot 1
  - Main author power cables study&coordinator: Paul Van Tichelen
  - Co-authors:
    - Dominic Ectors (market and use data, ..)
    - Marcel Stevens (technical standards, ..)
    - Wai Chung Lam (LCA, MEErP and scenarios, ..)
  - Administrative contacts:
    - Magalie Wellens +32 14 33 58 04
    - Katrien Bultynck +32 14 33 59 96
  - Website: Karel Styns (webmaster).

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Introduction ErP Directive

- Background is the Ecodesign Directive 2009/125/EC:
  - Framework Directive
  - binding requirements through 'Implementing Measures' (EC Regulation ..)
  - For products but it is possible to introduce information requirements for components and sub-assemblies
  - Product groups are first identified in a Working Plan, such as power cables in the 2nd working plan year 2012-2014
  - **A preparatory study provides the necessary information to prepare for the next phases in the policy process, a.o.: impact assessment, the consultation forum, ..)**
  - Approach of preparatory study is well defined in the Methodology for the Ecodesign of Energy-related Products (MEErP)
  - Further info: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm

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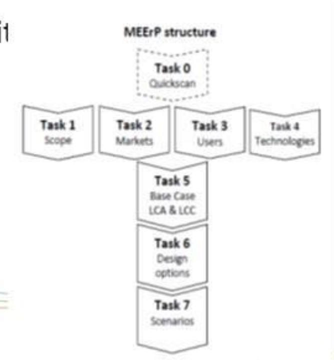
MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
- Task 1 - Scope (definitions, standards and legislation, first screening);
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
- Task 4 - Technologies (product supply side, includes both BAT and BNAT);
- Task 5 – Environment & Economics (Base case LCA & LCC);
- Task 6 – Design options;
- Task 7 – Scenarios (Policy, scenario, impact and sensitivit
- Tasks 1 to 4 can be performed in parallel



Task 1 Scope

- **Identify relevant** Prodcom/ EN&ISO/ Labelling **categories > Stakeholder input!**
  - Define preliminary product scope, definition, primary ("functional unit")
  - Define secondary performance parameters:
- Test **standards**, also **under development**
- Legislation
- First screening

Task 2 Market Data

- Generic economic data (.. Eurostat?)
- Market and Stock data
- Market trends
- Consumer expenditure base data
- Recommendations (.. Scope, barriers&opportunities)

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Task 3 Users

- **System aspects:**
  - **use phase energy consumption .. Cable losses**
- **End of Life behaviour**
- **Local infrastructure (barriers & opportunities)**
- Recommendations

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Task 4 Technologies

- Technical product description
  - Existing products.. **Working towards 'Base Cases'** (=conscious abstraction of reality' ..has to fit with previous tasks & workable model)
  - Improvement options: **BAT&BNAT**
- **Production, distribution and end&of&life** > BOM > Ecoreport format&tool
- Recommendations

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Task 5-7

- **Task 5: Environment Economics**
  - Base Case Environmental Impact Assessment(EcoReport Tool)
  - Base Case Life Cycle Costs for consumer
  - Base Case Life Cycle Costs for society
  - EU wide impact
- **Task 6: Design options**
  - .. Identify LLCC & BAT > target levels & benchmark values
  - .. Long term potential& system analysis
- Task 7: Scenarios
  - Policy analysis

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Task 7 Scenarios

- Task 7: Scenarios
  - Policy analysis
  - Scenario analysis unit stock/sale & environmental
  - Impact analysis (socio) economic
  - Sensitivity Analysis
  - Summary

Note: MEErP 2011 is not an automatic law making procedure; the preparatory study is an analytical document at the responsibility of the contractor. Political and legislative choices, at the responsibility of the Commission, are indispensable in the follow up.

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Planning (preliminary)

- 28 Jun 2013 ■ Project kick-off meeting with EC
- July 2013 ■ Launch website www.erp4cables.net
- Aug 2013 ■ Launch first series of enquiries to registered stakeholders
- 5 dec 2013 ■ 1st stakeholder meeting on Draft Task 1-3
- **3 June 2014 ■ 2nd stakeholder meeting on Draft Task 1-5**
- Early Nov 2014 ■ 3rd stakeholder meeting on Draft Task 1-7
- End Feb 2015 ■ Publication Final Report Task 1-7

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 1

Paul Van Tichelen

Brussels, DG Enterprise
3rd of June2014

Task 1: Content

- "Product scope" of the study
- Product categories based on
  - Prodcom
  - EN- or ISO-standards
  - Other product-specific categories
- Definitions & Terminolgy
- Primary & secondary product performance parameters
- Product Standards & Legislation
  - EU level
  - Member state level
- First screening

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Task 1: Product scope

- Focus: "Installed power cables & wires **in** buildings"
  - Fixed wired; LV ($\leq$ 1000Vac)
- Excluded:
  - ...
  - Residential from Tasks 3-6
- **SCOPE proposal: Losses in installed power cables in buildings after the meter taking into account the installation as a system(circuit breaker, load ..)**

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Task 1: Product scope

- **Electric circuit**
- **Product categories**
  - Prodcom – NACE 27321380:
    "Other electric conductors, for a voltage < 1000V, not fitted with connectors" = Too broad: cords, flexible wires,... also included
  - **EN-, IEC-standards:**
    - **IEC 60228: "conductors of insulated cables"**
    - **Class-1(solid), -2(stranded),-5(flexible),-6(very flexible)**
    - **IEC 60227-1: PVC cables – 5 categories**
    - **IEC 60245-1: Rubber insulated cables – 5 categories**
    - **....**
  - **Other possibilities:** categories according to
    - **Field of application**, composition of the cable...

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Task 1: Product performance parameter

- Primary product performance paramater or "Functional unit":
  - **"Current-Carrying capacity" of the cable/conductor [Amperes]**
    - **Rated current of the circuit ?**
  - *"the maximum value of electric current which can be carried continuously by a conductor (a cable), under specified conditions without its steady-state temperature exceeding a specified value (see IEV 826-11-13)"*
- Secondary product performance parameters
  - Construction of the cable (see Task 2)
    - **'Nominal' CSA**, DC resistance, Rated voltage, insulation material, conductor material, number of cores, construction of the conductor, maximum diameter….
  - Use of the cable (see Task 3)
    - Electrical installation: Supply param., installation method, Tamb…
    - Circuit level: dV, I load, I max, LF, Kf, PF, Kd…..

Task 1: Measurement & test standards

- Conductors & cables
  - EN13601 & -13602: Copper and copper alloys
  - **EN 60228**: Conductors of insulated cables
    - Class1,2,5,6; Links **'Nominal CSA with Rdc max'**, …
  - EN 50525-1: Low voltage energy cables
  - EN 50395: Electrical test methods for low voltage energy cables

Task 1: Measurement & test standards

- Electrical installation:
  - **(IEC)HD 60364-5-52**: LV electrical installations – ... wiring systems
    - Correction factors, methods of installation, **dV max**, ...
  - IEC 60287-1-1: Calculation of current rating & losses -100% load factor
  - **IEC 60287-3-2**: Calculation of current rating – **Economic optimization single cable segment – not for distributed loads**
  - IEC 60364-6: Low Voltage electrical installations – verification
  - **IEC 60364-8-1 / FprHD 60364-8-1: 2013: Low voltage electrical installation - Part 8-1: Energy efficiency – DRAFT version:**
    - **Reduction of energy losses in wiring:**
      - **Reducing the voltage drop. Reference to IEC 60364-5-52;**
      - **Increasing the cross sectional area. Reference to IEC 60287-3-2;**
      - **Power factor correction to improve the power factor of the load circuit;**
      - **Reduction of harmonic currents at the load level.**
    - **Qualitative but not quantitative ?**

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Legislation

- EU Directives applicable on LV cables
- Member state level
  - National wiring regulation rules
  - Overview of national wiring regulations available ?
- Third country legislation ??
- Voluntary initiatives: e.g. ELEKTRO+ (Ge), ACI (UK),..

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Insulation materials (I)

» Most used insulation materials voor electric cables & wires:

Type	Name	Tmax oper.
PVC	Polyvinyl Chloride	70°C
XLPE	Cross-Linked PolyEthylene	90°C
EPR	Ethylene Propylene Rubber	90°C

» Low Smoke Halogen free insulation materials
- » Based on Thermoplastic Elastomeren (TPE) compounds (e.g. PE, PP)
- » Compliant to:
  - » IEC 60754-1: Amount of halogen acid gas
  - » IEC 60754-2: Degree of acidity of gases
  - » IEC 61034-2: Smoke density

Insulation materials (II)

» Flame retardant wires /cables:
- » Single wire: Compliant to IEC 60332-1/2
- » Bundled cables: Compliant to IEC 60332-3

» Fire resitant cable:
- » Compliant to IEC 60331-21 (Uo/U≤0,6/1 kV)

Task 1: First screening

- **Note: these values are updated in later chapters!**
- Focus in taks 3-6 on service and industry sector

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 2

Paul Van Tichelen

Brussels, DG Enterprise

3rd of June 2014

Content

Sales data

- Prodcom sales data: 2200 kTon in 2010 (broad range, incl. data ..)
- ECI:
  - World demand for copper: 24200 kTon Cu
  - Estimate 48 % for Cables: 11000 kTon Cu
- Sales (from working plan) (2010):
  - Industry: 241 kTon Cu
  - Services: 216 kTon Cu
  - Residential: 284 kTon Cu
    - = Total: 760 kTon
- CRU report: 1073 kTon (all LV cables also distribution grid)

Stock data

- Working plan: 18788 kTon (equivalent to 25 years service life)
- Background data on floor area:
  - BPIE: 24000 M m^2 from which about 75 % residential (18000 M m^2)
  - Ecofys (non-residential): 12356 M m^2
  - 24000 Mm^2/ 501 M habitants = 48 m^2 per habitant
  - note: figures are probably higher?
- Background data on energy consumption (see task 5):
  - Electric Energy demand Residential (2010): about 800 TWh
  - Electric Energy demand Industry (2010): 1080 TWh
  - Energy demand service&other (2010): about 887 TWh
- Stock per floor space area
  - Residential (ECI): 0,291 kg/m^2
  - Non-residential: 0,54 kg/m^2 (service) – 1,39 kg/m^2 (industry) (working plan

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Stock

- Working plan: 18788 kTon (related to sales & 25 years service life)
- Power cable stock = building stock floor area x kg cable/m^2
- Buildings (BPIE):
  - **24 billion m^2** of useful floor space (industry floor space excluded?)
  - The residential stock : 75% of the building stock: 18 billion
- Buildings (Ecofys study):
  - non-residential building stock: 12.3566 – 13.2906 billion m^2
  - industry building stock: 2.752 billion m^2
- **29 – 139 kg/100m^2 depending on sector** (based upon CuIoU survey)
- Results in:
  - Residential buildings: 5241 kTon versus 7515 kTon in working plan
  - Services buildings: 3250 kTon versus 4734 kTon in working plan
  - Industry buildings: 3825 kTon versus 6538 kTon in working plan

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Example of office building (Vito)

Table 2-14: Example of an real office building

Amount of Ligth circuits	33
Amount of Socket outlet circuits	62
Amount of Dedicated circuits	34
Amount of Main feeders	1
Amount of Sub feeders	11
Cu total (kg)	2851
Floorspace (m²)	3059
Cu (kg/100m²)	93

Distribution of power cables based upon CSA residential buildings

Table 2-15: Distribution of LV cables in the residential buildings[1]

CSA (mm²)	% Weight	% Length
1.5	23.4	27.5
2.5	38.9	40
4	6,6	4.9
6	9,3	5.7
10	6.1	<1

The total length of 1.5 +2.5 mm² cables counts for 67.5% of the total length of the installed cables in the residential sector.

[1] Source: CuIoU survey European Copper Institute

Distribution of power cables based upon CSA non-residential buildings

Table 2-16: Distribution of LV cables in non-residential buildings[1]

CSA (mm^2)	% Weight	% Length
1.5	2	15
2.5	13	58.6
4	2	4.9
6	3	5.1
10	3	3.2
16	3	2.4
25	4	2
35	6	1.9
50	5	1.2
70	11	1.8
95	12	1.4
120	9	0.9
150	6	0.4
185	13	0.8
240	7	0.4
300	0	0
400	3	0.1
500	0	0
600	0	0

The total length of 1.5 +2.5 mm^2 cables counts for 73.6% of the total length of the installed cables in the non-residential sector.

[1] Source: CuIoU survey European Copper Institute

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Sales rate and stock data summary

Table 2-18: Summary of growth rates

Sector	Stock growth rate	Replacement sales rate	New sales rate	Total sales rate	Stock (Reference year: 2010)
Unit	% p.a.	% p.a.	% p.a.	% p.a.	kTon Cu
Residential sector	1.00%	0.59%	1.00%	1.59%	7515
Services sector	2.10%	7.08%	2.10%	9.18%	4734
Industry sector	3.10%	7.08%	3.10%	10.18%	6538
Total sector (weighted)	2.01%	4.48%	2.01%	6.49%	18787

Table 2-21: Is stock correct???

Sector	Building floor area	Amount of Cu material per 100m² empirical	Amount of Cu material per 100m² according working plan
Unit	Million m²	kg/100m²	kg/100m²
Residential	18000	29.1	41.75
Services	6000	54	78.9
Industry	2752	139	237

Source: BPIE, Ecofys study, Heinze study,

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Product cost

- Product unit is (CSA [mm²] x l [m] x N).
- Product cost
  - Average user price (web shops - 2013) around
    - **0.075 €/ (mm²x m x 1 core)**.
  - Average (2005-2010) factory price (ProdCom) around
    - **0.047 €/ mm² x m**.

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Other costs, installation time (source: ECI)

Section	Installation time per meter	Installation time for the cable ends
mm2	Min	Min
1	1.75	5
1.5	2.45	7
2.5	3.15	9
4	3.85	12
6	5.25	12
10	5.95	15
16	7	17
25	8.75	20.4
35	9.8	25.5
50	10.5	30.6
70	11.9	36
95	12.6	45
120	14	45
150	15.75	60
185	17.5	60
240	21	85
300	24.5	120
400	28	200
500	35	360
630	42	480

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 3

Paul Van Tichelen

Brussels, DG Enterprise
3rd of June 2014

Task 3 Users

- **Systems aspects of the use phase for ErPs with direct impact**
  - Definition of the User and context
  - Loss parameters directly related to the cable itself
  - Other functional cable parameters not directly related to losses
  - Loss parameters directly related to the electrical circuit and network topology
  - Parameters related to the building and loading
  - Formulas used for power losses in cables
- **Systems aspects of the use phase for ErPs with indirect impact**
- **End of Life behaviour**
- Local infrastructure (barriers & opportunities), e.g. cable bending
- Recommendations

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Product to systems approach

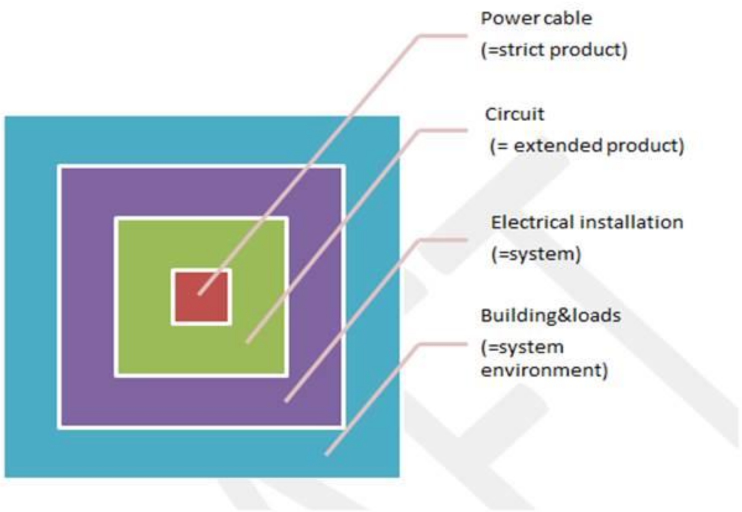

Figure 3-1: From strict product to systems approach

Loss parameters directly related to the cable itself

» R= ρ_t.l/A (Ohm) (formula 3.2)

» 3.1.2.1 Conductor material electrical resistance
» 3.1.2.2 **Cross-sectional area (CSA)**
» 3.1.2.3 Length of cable
» 3.1.2.4 Number of cores
» 3.1.2.5 Skin effect

CSA per circuit application type & sector

Table 3-2: Typical cable cross sectional areas depending on the circuit type

Sector	Circuit application type	CSA (mm²) min	CSA (mm²) ref	CSA (mm²) max
Residential	Distribution circuit	6	10	16
	Lighting circuit	1	1.5	2.5
	Socket-outlet circuit	1.5	2.5	6
	Dedicated circuit	2.5	4	6
Services	Distribution circuit	10	35	600
	Lighting circuit	1.5	1.5	2.5
	Socket-outlet circuit	1.5	2.5	6
	Dedicated circuit	2.5	35	95
Industry	Distribution circuit	25	95	600
	Lighting circuit	1.5	1.5	2.5
	Socket-outlet circuit	1.5	2.5	10
	Dedicated circuit	2.5	35	600

Own estimates
New input from stakeholder, not processed yet.

Other functional cable parameters not directly related to losses

- **Insulation material > see OVAMs paper**
- Construction of the conductor

Loss parameters directly related to the electrical circuit and network topology

- 3.1.4.1 Single phase or three phase circuit
- 3.1.4.2 Maximum voltage drop in a circuit
- 3.1.4.3 Overcurrent protection in a circuit
- 3.1.4.4 Circuit network topology
- 3.1.4.5 **Circuit length**
- 3.1.4.6 Effect of load distribution
- 3.1.4.7 Effect of not simultaneous functioning of distributed loads
- 3.1.4.8 Ambient temperature
- 3.1.4.9 Temperature effect caused by the 'method of installation'
- 3.1.4.10 Single or three phase system
- 3.1.4.11 Number of distribution levels
- 3.1.4.12 Rated Diversity Factor DF at installation level

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Circuit length

- Based upon enquiry, but corrected (factor 1. 2 for branches in lighting circuits)

Table 3-6: Corrected (and rounded) average circuit length in meters

Sector	Circuit application type	Average length min (m)	Average length ref (m)	Average length max(m)
Residential	Distribution circuit	5	17	40
	Lighting circuit	12	21	3
	Socket-outlet circuit	5	20	50
	Dedicated circuit	5	17	40
Services	Distribution circuit	10	34	80
	Lighting circuit	14	38	72
	Socket-outlet circuit	10	31	65
	Dedicated circuit	10	34	80
Industry	Distribution circuit	15	72	200
	Lighting circuit	24	65	120
	Socket-outlet circuit	15	48	100
	Dedicated circuit	15	72	200

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Parameters related to the building and loading

- 3.1.5.1 **Load Factor (αc) and load form factor (Kf)**
- 3.1.5.2 Power factor
- 3.1.5.3 Impact of harmonics
- 3.1.5.4 Number of loaded conductors and impact of phase imbalance and harmonics

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Load factors (αc) and load form factors (Kf)

- Load factor α_c (**LF**)=Pavg/Srated (Srated: rated apparent power)
- Load Form factor Kf = Prms/Pavg

Table 3-12: Load form factor and load factors to be used in this study

		Lighting circuit			Socket-outlet circuit			Dedicated circuit			Distribution circuit		
		Low	Ref	High	Low	Ref	High	Low	Ref	High	Low	Ref	High
Residential sector	Kf	3.12	2.11	1.67	4.38	1.74	1.34	4.61	3.99	3.12	1.24	1.14	1.08
	α_c	0.02	0.05	0.10	0.00	0.04	0.10	0.01	0.02	0.05	0.03	0.06	0.22
	Kf . α_c	0.06	0.11	0.17	0.02	0.06	0.13	0.05	0.08	0.14	0.03	0.07	0.23
Services sector	Kf	1.50	1.27	1.16	1.50	1.27	1.16	1.37	1.21	1.13	1.37	1.21	1.13
	α_c	0.15	0.24	0.41	0.07	0.15	0.24	0.29	0.41	0.54	0.29	0.41	0.54
	Kf . α_c	0.22	0.31	0.48	0.11	0.19	0.27	0.39	0.49	0.61	0.39	0.49	0.61
Industry sector	Kf	1.11	1.06	1.03	1.11	1.06	1.03	1.03	1.01	1.00	1.05	1.02	1.01
	α_c	0.23	0.34	0.54	0.12	0.27	0.46	0.46	0.61	0.76	0.43	0.57	0.72
	Kf . α_c	0.26	0.36	0.55	0.13	0.29	0.47	0.47	0.61	0.76	0.45	0.58	0.72

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Formula 3.2 used for power losses in cables

$R_t = \rho_t . l / A$ (Ω) (formula 3.2)

where,

- R_t = resistance of the conductor at temperature t (Ω)
- l= length of the cable (meter)
  - **Length = circuit length x number of loaded conductors (2 or 3)**
- A= cross sectional area of the conductor (mm^2)
- ρ_t is specific electrical resistivity of the conductor at temperature t (Ω.mm^2/m)

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Formula 3.5 used for power losses in cables

Ecircuit,(y) [kVAh] = Kd . Rt . $Imax^2$. $(\alpha c . Kf)^2$. 8760 / 1000 (formula 3.5)

where,

- Kd = the distribution factor
- R_t = cable resistance at temperature t (see formula 3.2)
- Imax = the maximum rated current of the cable
- α_c = The **corrected** load factor
- Kf = Load form factor (=Prms/Pavg)
- PF = the power factor of the load served by the power cable

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Formula Active energy transported &loss ratio

Eactive(y) [kWh] = √3 . V . Imax . αc . Kf . PF . 8760 / 1000 (three phase)

where,

- V = electrical installation voltage (V =230 for single phase and 400 for three phase)
- Imax = the maximum rated current of the cable
- αc = The corrected load factor
- Kf = Load form factor (=Prms/Pavg)
- PF = the power factor of the load served by the power cable

Loss ratio = Ecircuit (y)/ Eactive(y)

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End-of-Life behaviour, Ecotool input parameters

Sector	Product life	Service life	Vacancy
Unit	Year	Year	%
Residential sector	169.49	161.02	5%
Services sector	14.12	13.42	5%
Industry sector	14.12	13.42	5%
Total sector (weighted)	76.27	72.46	5%

	Bulk Plastics	TecPlastics	Ferro	Non-ferro	Coating	Electronics	Misc., excluding refrigant & Hg	refrigerant	Hg (mercury), in mg/unit	Extra	Auxiliaries
EoL mass fraction to re-use, in %	1%	1%	1%	0%	1%	1%	1%	1%	1%	1%	5%
EoL mass fraction to (materials) recycling, in %	29%	29%	94%	95%	94%	50%	64%	30%	39%	60%	30%
EoL mass fraction to (heat) recovery, in %	15%	15%		0%		0%	1%	0%	0%	0%	10%
EoL mass fraction to non-recov. incineration, in %	22%	22%		0%		30%	5%	5%	5%	10%	10%
EoL mass fraction to landfill/missing/fugitive, in %	33%	33%		5%		19%	29%	64%	55%	29%	45%

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 4

Paul Van Tichelen

Brussels, DG Enterprise
3rd of June 2014

Task 4: Technologies

- BAT
  - Product level (power cable)
  - System level (electrical installation/-circuit)
- BNAT
  - Product level (power cable)
  - System level (electrical installation/-circuit)
- Production, distrubition and End of Live (Task 3)
- Improvement options & recommendations

Task 4: BAT

- BAT at Product level (power cable)
  - BAT to improve Energy losses
    - **Maximum resistance** / CSA, composition Cu/Al … in EN standards
    - Variations in conductivity → modification "real" CSA (< d max)
    - → No improvement potential at product level
  - BAT to improve impact from material usage: ?

- BAT at System level (electrical installation/-circuit)
  - Increasing CSA of the cables (power losses ↘)
  - Power factor correction (reactive energy losses ↘)
  - Reduction of harmonic currents (power losses ↘),…..
  - → see FprHD 60364-8-1 "LV electrical installations – energy efficiency"

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Task 4: Technologies - BNAT

- BNAT at Product level (power cable)
  - ?

- BNAT at System level (electrical installation/-circuit)
  - Energy efficiency at appliance level
  - Building and home automation
  - Peak reduction control systems
  - DC power distribution in commercial buildings
  - Note: BNAT? With the purpose to decrease cable losses

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Task 4: Production, distrubition and End of Live

- Production: Bill of Material – manufacturing process: see OVAM paper
  - Representative cable
    - Conductor: Cu; Flexibility: Class 1 and 2 (IEC 60228)
    - Insulation material: XLPE (Cross-Linked Polyethylene)
    - Sheath material: PVC (Polyvinyl Chloride)
    - Voltage rating: 0.6/1 kV
    - Standard: IEC 60502-1
  - Insulation- & sheath weight: calculated according to IEC 60502-1
  - Filler material (FM):
    - PVC
    - Weigth FM= Avg. Cable Weigth - Weigth (Cu +XLPE+PVC)

Task 4: BOM

- Spreadsheets\BoM.xlsx

Task 4: Distribution

- Packaging
  - In cartons & plastic: small CSA & -lengths
  - Drums/reels: larger CSA & -lengths
- Drums:
  - Different sizes
  - Recuperated
- Volume
  - Vproduct = Vdrum / lmax . lproduct (m^3)

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Distribution example

Dc (mm)- Ficitious diameter - acc. To IE	mm	6.05
Drum Size		10
Max. cable length	m	1952
Drum Volume (formula	m^3	0.70
Drum spacing	m^3	0.11
Correction factor (spacing)	%	15%
Drum Corrected Volume	m^3	0.81
Drum Weight	kg	50.00
Drum corrected volume / meter cable	m^3/m	0.00041
Drum Weigth / meter cable	g/m	25.6

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Task 4: Improvement options & Recommendations

Option Name	Description	In the scope of this study
At cable level		
Low loss cable as a product	Because no BNAT technologies are available at cable level that could reduce the energy losses in an economical feasible manner. Labelling information on the cable about energy losses is not a scenario and can be implemented by the scenarios mentioned in "at circuit level" part.	Not applicable
Cable with low impact insulation material	Under consideration, more input is needed	?
At circuit level (system level)		
S+x scenario	Using, for a particular circuit and load, a cable with a larger CSA (S+x) than necessary (according current standards and regulation) will result in a lower cable resistance R_c and thus lower energy losses. The CSA increments are conform the current, standardized CSA values (no new CSA values are considered).	Yes
2S scenario	By installing, for a particular circuit and load, instead of one cable with a particular CSA_x one or more cables in parallel with the same CSA (or even smaller CSA than the original foreseen CSA_x) the losses in the circuit can be reduced.	Yes
Topology scenario	Keeping the topology in mind when designing the electrical system of a building can reduce the energy losses in the circuits. For instance, to keep losses to a minimum, the main distribution transformers and switchboards are to be located to keep the distances (circuit lengths) to main loads to a minimum. The building's use, construction and space availability has to be taken into account to obtain the best position. One such method to determine the best position is the barycentre method.	No?

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 5

Dominic Ectors

Brussels, DG Enterprise
3rd of June2014

Task 5: aim

- **Task 5: Environment Economics**
  - Base Case Environmental Impact Assessment(EcoReport Tool)
  - Base Case Life Cycle Costs for consumer
  - Base Case Life Cycle Costs for society
  - EU wide impact

- to assess environmental and economic impacts of the different base cases.
- based upon EcoReport Tool version 3.06 , as provided with the MEErP 2011 methodology.

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Task 5 content (1)

- 5.1 Product-specific inputs
  - 5.1.1 Identification of base cases
  - 5.1.2 Manufacturing of the product: Bill Of Materials
  - 5.1.3 Distribution phase: volume of packaged product
  - 5.1.4 Use phase
  - 5.1.5 End of Life (EoL)
  - 5.1.6 Life Cycle Cost Inputs
- 5.2 Base case environmental impact assessment (using EcoReport)
- 5.3 Base case Life Cycle Cost for consumer
- 5.4 Base case Life Cycle Costs for society

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Task 5 content (2)

- 5.5 EU totals
  - 5.5.1 Stock specific inputs
  - 5.5.2 Environmental impact at EU-28
  - 5.5.3 Economic assessment at EU-28
- 5.6 Cross checks

5.1 PRODUCT-SPECIFIC INPUTS

5.1 Product-specific inputs
5.1.1 Identification of base cases

» Selection criteria

Base case identification

» Base case 1: A typical power cable for use in typical **lighting circuit** in the **services sector**

» Base case 2: A typical power cable for use in typical **distribution circuit** in the **services sector**

» Base case 3: A typical power cable for use in typical **distribution circuit** in the **industry sector**

» Base case 4: A typical power cable for use in typical **dedicated circuit** in the **services sector**

» Base case 5: A typical power cable for use in typical **dedicated circuit** in the **industry sector**

Base Case 1: Services sector - Ligthing circuit

- Multi wire cable:
  - CSA: 1,5mm² → 3G1,5mm²: L-, N-, PE-wire
  - Average length: 38m
- Circuit breaker: 10A
- Maximum apparent power: 10Ax230V= 2,3 kVA

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Base Case 2: Services sector – Distribution circuit

- Circuit between transformer and main distribution board
- 400kVA transformer – commonly used
- Multiwire cable
  - CSA 120mm²→ 5G120mm²: L1-, L2-, L3-, N-, PE-wire
  - Average length: 34m
  - 2 cables in parallel
- Circuit breaker
  - 630 A (Ir setting 577A)

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Base Case 3: Industry sector – Distribution circuit

- Circuit between transformer and main distribution board
- 1250kVA transformer – commonly used
- Multiwire cable
  - CSA 300mm² → 4x300mm²: L1-, L2-, L3-, N-wire
  - Average length: 72m
  - 4 cables in parallel
- Circuit breaker
  - 2000 A (Ir setting 1804 A)

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Base Case 4: Services sector – Dedicated circuit

- Circuit between distribution board and consumer
- Multiwire cable
  - CSA 10mm² → 5G10 mm²: L1-, L2-, L3-, N-, PE-wire
  - Average length: 34m
- Circuit breaker: 63A
- Maximum apparent power= 43kVA

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Base Case 5: Industry sector – Dedicated circuit

- Circuit between distribution board and consumer
- Multiwire cable
  - CSA 35mm² → 5G35 mm²: L1-, L2-, L3-, N-, PE-wire
  - Average length: 72m
- Circuit breaker
  - 160A (Ir setting 156A)
- Maximum apparent power= 108kVA

5.1.2 Manufacturing of the product: Bill Of Materials

- Reference Cable
  - Conductor:
    - Material: Cu
    - Flexibility: Class 1 and 2 (IEC 60228)
  - Insulation material: XLPE (Cross-Linked Polyethylene)
  - Sheath material: PVC (Polyvinyl Chloride)
  - Voltage rating: 0.6/1 kV
  - Single- and multicore
  - Armoured: No
  - Standard: IEC 60502-1

5.1.2 Bill Of Materials: base cases

Base case id		BC1	BC2	BC3	BC4	BC5
Sector		Services sector	Services sector	Industry sector	Services sector	Industry sector
Application circuit		Lighting circuit	Distribution circuit	Distribution circuit	Dedicated circuit	Dedicated circuit
BoM per meter cable						
CSA	mm^2	1.50	120.00	300.00	10.00	35.00
Cu	g/m	40.01	5,334.00	10,668.00	444.50	1,555.75
XLPE	g/m	12.88	238.41	448.07	43.97	99.92
PVC	g/m	66.57	478.79	820.05	129.78	210.34
Filler material	g/m	40.54	1,300.81	1,933.88	141.25	390.98
Total weight material	g/m	160.00	7,352.00	13,870.00	759.50	2,257.00
BoM per base case						
Cu	g	1,520.19	362,712.00	3,072,384.00	15,113.00	112,014.00
XLPE	g	489.62	16,211.82	129,043.88	1,495.02	7,194.35
PVC	g	2,529.63	32,557.38	236,173.68	4,412.49	15,144.74
Filler material	g	1,540.57	88,454.79	556,958.44	4,802.48	28,150.91
Total weight material	kg	6.08	499.94	3,994.56	25.82	162.50

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5.1.3 Distribution phase: volume of packaged product

	Unit	BC1	BC2	BC3	BC4	BC5
Cable outer diameter	mm	9.65	44.76	61.82	17.10	26.56
Drum Size		10	22	22	14	18
Max. cable length	m	2810	842.00	443.00	2448.00	1926.00
Drum Volume (formula	m^3	0.70	6.04	9.04	1.80	4.04
Drum spacing	m^3	0.11	0.91	1.36	0.27	0.61
Correction factor (spacing)	%	15%	15%	15%	15%	15%
Drum Corrected Volume	m^3	0.81	6.95	10.40	2.07	4.65
Drum Weight	kg	50.00	450.00	595.00	125.00	290.00
Drum corrected volume / meter cable	m^3/m	0.00029	0.00825	0.02348	0.00085	0.00241
Drum Weigth / meter cable	g/m	17.8	534.4	1343.1	51.1	150.6

	Unit	Bases cases definiton				
Base case id		BC1	BC2	BC3	BC4	BC5
Sector		Services sector	Services sector	Industry sector	Services sector	Industry sector
Application circuit		Lighting circuit	Distribution circuit	Distribution circuit	Dedicated circuit	Dedicated circuit
Volume package						
Volume package per meter cable	m3	0.000286477	0.008249843	0.023475576	0.000847092	0.002414355
Volume package per base case	m3	0.01089	0.56099	6.76097	0.02880	0.17383

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5.1.4 Use phase

Parameter	Unit	Base cases				
Base case id		BC1	BC2	BC3	BC4	BC5
Sector		Services sector	Services sector	Industry sector	Services sector	Industry sector
Application circuit		Lighting circuit	Distribution circuit	Distribution circuit	Dedicated circuit	Dedicated circuit
Loaded cores		2	6	12	3	3
Cables in parallel		1	2	4	1	1
Conductor material		Cu	Cu	Cu	Cu	Cu
Imax per cable	A	10	289	451	62	156
CSA	mm²	1.5	120	300	10	35
Length of circuit	m	38	34	72	34	72
ρ_t	Ω.mm²/m	0.0167	0.0167	0.0167	0.0167	0.0167
R (formula 3.2) per wire	Ω	0.423	0.005	0.004	0.057	0.034
Kd		0.38	1.00	1.00	1.00	1.00
Kf		1.27	1.21	1.02	1.21	1.01
αc		0.24	0.41	0.57	0.41	0.61
Pf		1.00	0.80	0.80	0.80	0.80
Annual energy loss (formula 3.5) per loaded core	kVAh	13.42	841.42	2441.35	466.74	2762.15
Annual energy loss (formula 3.5) per BC	kVAh	26.85	5048.54	29296.26	1400.21	8286.46
Annual energy transported (formula 3.6) per BC	kWh	6,233.33	1,383,543.21	5,121,229.66	148,730.89	465,153.33
Energy loss ratio (formula 3.7)		0.43%	0.36%	0.57%	0.94%	1.78%

$E_{circuit,}(y)$ [kVAh] = Kd . R_t . $I_{circuit}^2$. (α . Kf)² . 8760 / 1000 (formula 3.5)

$E_{active}(y)$ [kWh] = $\sqrt{3}$. V . $I_{circuit}$. α . Kf . PF . 8760 / 1000 (1-,3-phase) (formula 3.6)

Loss ratio = $E_{circuit}(y) / E_{active}(y)$ (formula 3.7)

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5.1.5 End of Life (EoL)

- Defaults values of the EcoReport have been used for recycling rates of the materials
- Only the re-use of metals is set to 0% instead of 1% and recycling of metals is set to 95% instead of 94% (see section 3.3 in Task 3)

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5.1.6 Life Cycle Cost Inputs

	Unit	Bases cases definiton				
Base case id		BC1	BC2	BC3	BC4	BC5
Sector		Services sector	Services sector	Industry sector	Services sector	Industry sector
Application circuit		Lighting circuit	Distribution circuit	Distribution circuit	Dedicated circuit	Dedicated circuit
LCC data						
Year		2010	2010	2010	2010	2010
Electricity rate	€/kWh	0.11	0.11	0.11	0.11	0.11
Product price for 1 meter cable	€	0.82	58.23	116.45	6.11	18.10
Bace case product price	€	31.16	3959.30	33537.60	207.74	1303.20
Base case installation cost	€	39.54	205.80	744.18	85.83	288.78
Product life	Year	14.12	14.12	14.12	14.12	14.12
Product service life	Year	13.42	13.42	13.42	13.42	13.42

real product prices 2014 (not formula)

Cost per meter + ends (2, should be per node)

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5.2 BASE CASE ENVIRONMENTAL IMPACT ASSESSMENT (USING ECOREPORT)

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EcoReport tool: input summary

	Unit	Base cases: ecoreport input				
Base case id		BC1	BC2	BC3	BC4	BC5
CSA	mm^2	1.5	120	300	10	35
Cu	g/m	1520.19	362712.00	3072384.00	15113.00	112014.00
XLPE	g/m	489.62	16211.82	129043.88	1495.02	7194.35
PVC	g/m	2529.63	32557.38	236173.68	4412.49	15144.74
Annual energy loss (formula 3.5) per BC	kVAh	26.85	5048.54	29296.26	1400.21	8286.46
Volume	m3	0.01	0.56	6.76	0.03	0.17
Product life	Year	14.12	14.12	14.12	14.12	14.12
Bace case product price	€	31.16	3959.30	33537.60	207.74	1303.20
Annual sales (base case units)	mln. Units	32.86	0.42	0.04	1.76	1.44
EU Stock (base case units)	mln. Units	464.07	5.98	0.51	24.85	20.27
Base case installation cost	€	39.54	205.80	744.18	85.83	288.78
Electricity rate	€/kWh	0.11	0.11	0.11	0.11	0.11
Filler material	g	1540.57	88454.79	556958.44	4802.48	28150.91
EoL mass fraction to re-use, non-Ferro material	%	0%	0%	0%	0%	0%
Product service life	Year	13.42	13.42	13.42	13.42	13.42

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EcoReport tool: base cases

» Spreadsheets\EcoReport_v3_06_BC1.xlsx
» Spreadsheets\EcoReport_v3_06_BC3.xlsx

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5.3 BASE CASE LIFE CYCLE COST FOR CONSUMER

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Base Case Life Cycle Cost for consumer

	Unit	Bases cases definiton				
Base case id		BC1	BC2	BC3	BC4	BC5
Sector		Services	Services	Industry	Services	Industry
Application circuit		Lighting	Distribution	Distribution	Dedicated	Dedicated
Product price	€	€ 31.16	€ 3,959.30	€ 33,537.60	€ 207.74	€ 1,303.20
Installation/ acquisition costs (if any)	€	€ 39.54	€ 205.80	€ 744.18	€ 85.83	€ 288.78
Electricity	€	€ 39.62	€ 7,843.77	€ 45,516.79	€ 2,175.47	€ 12,874.45
Total	€	€ 110.32	€ 12,008.87	€ 79,798.57	€ 2,469.04	€ 14,466.43
Product price	%	28%	33%	42%	8%	9%
Installation/ acquisition costs (if any)	%	36%	2%	1%	3%	2%
Electricity	%	36%	65%	57%	88%	89%
Total	%	100%	100%	100%	100%	100%

Cost per meter + ends (2, should be per node)

Running costs discounted to their Net Present Value

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5.4 BASE CASE LIFE CYCLE COSTS FOR SOCIETY

5.4 Base case Life Cycle Costs for society

	Unit	Bases cases definiton									
Base case id		BC1		BC2		BC3		BC4		BC5	
Sector		Services		Services		Industry		Services		Industry	
Application circuit		Lighting		Distribution		Distribution		Dedicated		Dedicated	
Product price	€	€	31.16	€	3,959.30	€	33,537.60	€	207.74	€	1,303.20
Installation/ acquisition costs (if any)	€	€	39.54	€	205.80	€	744.18	€	85.83	€	288.78
Electricity	€	€	39.62	€	7,843.77	€	45,516.79	€	2,175.47	€	12,874.45
External damages total, of which	€	€	14.80	€	2,853.02	€	20,314.59	€	466.55	€	2,839.66
- production PPext	€	€	5.80	€	1,011.41	€	8,633.25	€	43.72	€	314.19
- lifetime operating expense N*OEext	€	€	7.46	€	1,478.00	€	8,602.24	€	407.66	€	2,413.13
- end-of-life OELext	€	€	1.54	€	363.61	€	3,079.09	€	15.17	€	112.33
Total	€	€	125.12	€	14,861.89	€	100,113.15	€	2,935.60	€	17,306.09
Product price	%	25%		27%		33%		7%		8%	
Installation/ acquisition costs (if any)	%	32%		1%		1%		3%		2%	
Electricity	%	32%		53%		45%		74%		74%	
External damages total, of which	%	12%		19%		20%		16%		16%	
Total	%	100%		100%		100%		100%		100%	

Corrected (wrong in report and print)

5.5 EU TOTALS

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EU totals: stock specific input

	Unit	Bases cases definiton				
Base case id		BC1	BC2	BC3	BC4	BC5
Sector		Services sector	Services sector	Industry sector	Services sector	Industry sector
Application circuit		Lighting circuit	Distribution circuit	Distribution circuit	Dedicated circuit	Dedicated circuit
Stock and sales data (fixed total stock)						
Year		2010	2010	2010	2010	2010
EU Stock per base case cable (Cu weight)	kg	7.05E+08	2.17E+09	1.55E+09	3.76E+08	2.27E+09
EU Stock (units of 1 cable)	m	1.76E+10	4.07E+08	1.46E+08	8.45E+08	1.46E+09
EU Stock (base case units)	mln. Units	464.07	5.98	0.51	24.85	20.27
Annual sales (base case units)	mln. Units	32.86	0.42	0.04	1.76	1.44

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Environmental impact at EU-28 (annual)

	Unit	Bases cases definiton					
Base case id		BC1	BC2	BC3	BC4	BC5	Total
Sector		Services sector	Services sector	Industry sector	Services sector	Industry sector	
Application circuit		Lighting circuit	Distribution circuit	Distribution circui	Dedicated circuit	Dedicated circuit	
Materials							
Plastics	Mt	0.151	0.059	0.033	0.019	0.073	0.34
Ferrous metals	Mt	0.000	0.000	0.000	0.000	0.000	0.00
Non-ferrous metals	Mt	0.050	0.155	0.111	0.027	0.162	0.51
Other resources & waste							
Total Energy (GER)	PJ	132.94	294.36	149.10	317.99	1536.52	2,430.91
of which, electricity	TWh	12.89	30.36	14.92	34.86	168.18	261.19
Water (process)*	mln.m3	9.46	3.63	2.01	1.15	4.41	20.66
Waste, non-haz./ landfill*	Mt	0.08	0.15	0.07	0.16	0.79	1.26
Waste, hazardous/ incinerated*	kton	0.00	0.00	0.00	0.00	0.02	0.04
Emissions (Air)							
Greenhouse Gases in GWP100	mt CO2eq.	6.05	12.83	6.54	13.64	65.88	104.95
Acidifying agents (AP)	kt SO2eq.	38.61	97.39	58.12	67.29	333.95	595.36
Volatile Org. Compounds (VOC)	kt	2.52	6.08	2.99	7.00	33.77	52.35
Persistent Org. Pollutants (POP)	g i-Teq.	0.47	1.22	0.73	0.83	4.14	7.39
Heavy Metals (HM)	ton Ni eq.	4.10	11.30	7.48	4.66	24.24	51.77
PAHs	ton Ni eq.	0.65	1.48	0.92	0.88	4.42	8.35
Particulate Matter (PM, dust)	kt	2.07	2.43	1.73	1.53	7.48	15.25
Emissions (Water)							
Heavy Metals (HM)	ton Hg/20	5.24	15.76	11.03	3.88	21.79	57.70
Eutrophication (EP)	kt PO4	0.03	0.08	0.04	0.06	0.31	0.53

Too high

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Economic assessment at EU-28 (annual)

	Unit	Bases cases definiton					Total
Base case id		BC1	BC2	BC3	BC4	BC5	
Sector		Services	Services	Industry	Services	Industry	
Application circuit		Lighting	Distribution	Distribution	Dedicated	Dedicated	
Product price	mln. €	1023.79	1676.22	1201.30	365.55	1870.31	6137.18
Installation/ acquisition costs (if any)	mln. €	1299.11	87.13	26.66	151.04	414.45	1978.38
Electricity	mln. €	1370.37	3320.76	1630.39	3828.08	18476.95	28626.56
Total	mln. €	3693.28	5084.11	2858.35	4344.67	20761.71	36742.12
Product price	%	17%	27%	20%	6%	30%	100%
Installation/ acquisition costs (if any)	%	66%	4%	1%	8%	21%	100%
Electricity	%	5%	12%	6%	13%	65%	100%
Total	%	10%	14%	8%	12%	57%	100%

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5.6 CROSS CHECKS

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Used method: fixed stock

CSA Cu weight
1.5: 1.93%
2.5: 12.56%
4: 1.68%
.
.
.
630: 0.00%

→ BC1: 16.18%
→ BC2: 49.73%

x total kg Cu stock (per sector) → kg Cu per BC (EU-28) $\xrightarrow{L\text{, }CSA}$ # BC units per BC

Per BC unit

$E_{circuit}(y)$ [kVAh] = $Kd \cdot R_t \cdot Imax^2 \cdot (\alpha_c \cdot Kf)^2 \cdot 8760 / 1000$ → EU-28 electricity losses

$E_{active}(y)$ [kWh] = $\underline{\sqrt{3}} \cdot V \cdot Imax \cdot \alpha_c \cdot Kf \cdot PF \cdot 8760 / 1000$ → EU-28 active electricity transport

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Cross checks: fixed stock (sales, lifetime)

	Unit	Bases cases definiton					
Base case id		BC1	BC2	BC3	BC4	BC5	Total over all BC
Sector		Services	Services	Industry	Services	Industry	
Application circuit		Lighting	Distribution	Distribution	Dedicated	Dedicated	
Method 1: fixed stock	**kg**						**7.08E+09**
Energy distribution factor	%	10%	100%	100%	85%	85%	
EU Stock (base case units)	mln. Units	464.07	5.98	0.51	24.85	20.27	
Number of buildings per sector (Task 2 Table 2-9)	mln Units	11.41	11.41	2.58	11.41	2.58	
Annual energy loss (formula 3.5) per BC	kVAh	26.85	5048.54	29296.26	1400.21	8286.46	
Annual energy transported (formula 3.6) per BC	kWh	6,233	1,383,543	5,121,230	148,731	465,153	
Checks							
Annual energy loss Eu-28 (=BC loss * #BC units)	TWh	12.46	30.19	14.82	34.80	167.97	260.24
Annual energy transported Eu-28 (=BC annual energy transport * #BC units)	TWh	2,893	8,273	2,591	3,697	9,429	
Annual energy transported Eu-28 corrected with energy distribution factor	TWh	28,927	8,273	2,591	4,349	11,093	
Number of BC units (circuits) per building		40.7	0.5	0.2	2.2	7.9	

Too high

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Cross checks: fixed EU-28 electricity consumption

	Unit	Bases cases definiton					
Base case id		BC1	BC2	BC3	BC4	BC5	Total over all BC
Sector		Services	Services	Industry	Services	Industry	
Application circuit		Lighting	Distribution	Distribution	Dedicated	Dedicated	
Method 2: fixed EU-28 energy consumption	TWh		904	1030			1934
Energy distribution factor	%	10%	100%	100%	85%	85%	
Number of buildings per sector (Task 2 Table 2-9)	mln Units	11.41	11.41	2.58	11.41	2.58	
Annual energy transported (formula 3.6) per BC	kWh	6,233	1,383,543	5,121,230	148,731	465,153	
EU28 energy consumption (distributed via energy distribution factor)	TWh	90.41	904.12	1029.62	768.50	875.17	
Checks							
BC stock (= EU-28 energy consumption / energy transported per BC)	mln Units	14.50	0.65	0.20	5.17	1.88	22.41
BC stock (weight)	kg	2.20E+07	2.37E+08	6.18E+08	7.81E+07	2.11E+08	**1.17E+09**
Number of BC units (circuits) per building		1.3	0.1	0.1	0.5	0.7	

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Cross checks: fixed stock; L x 3, α /3

	Unit	Bases cases definiton					
Base case id		BC1	BC2	BC3	BC4	BC5	Total over all BC
Sector		Services	Services	Industry	Services	Industry	
Application circuit		Lighting	Distribution	Distribution	Dedicated	Dedicated	
Method 1: fixed stock	**kg**						**7.08E+09**
Energy distribution factor	%	10%	100%	100%	85%	85%	
EU Stock (base case units)	mln. Units	154.69	1.99	0.17	8.28	6.76	
Number of buildings per sector (Task 2 Table 2-9)	mln Units	11.41	11.41	2.58	11.41	2.58	
Annual energy loss (formula 3.5) per BC	kVAh	8.77	1649.36	9571.09	457.45	2707.19	
Annual energy transported (formula 3.6) per BC	kWh	2,057	456,569	1,690,006	49,081	153,501	
Checks							
Annual energy loss Eu-28 (=BC loss * #BC units)	TWh	1.36	3.29	1.61	3.79	18.29	28.34
Annual energy transported Eu-28 (=BC annual energy transport * #BC units)	TWh	318	910	285	407	1,037	
Annual energy transported Eu-28 corrected with energy distribution factor	TWh	3,182	910	285	478	1,220	
Number of BC units (circuits) per building		13.6	0.2	0.1	0.7	2.6	

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Cross checks: fixed EU-28 electricity consumption; L x 3, α /3

	Unit	Bases cases definiton					
Base case id		BC1	BC2	BC3	BC4	BC5	Total over all BC
Sector		Services	Services	Industry	Services	Industry	
Application circuit		Lighting	Distribution	Distribution	Dedicated	Dedicated	
Method 2: fixed EU-28 energy consumption	TWh		904	1030			1934
Energy distribution factor	%	10%	100%	100%	85%	85%	
Number of buildings per sector (Task 2 Table 2-9)	mln Units	11.41	11.41	2.58	11.41	2.58	
Annual energy transported (formula 3.6) per BC	kWh	2,057	456,569	1,690,006	49,081	153,501	
EU28 energy consumption (distributed via energy distribution factor)	TWh	90.41	904.12	1029.62	768.50	875.17	
Checks							
BC stock (= EU-28 energy consumption / energy transported per BC)	mln Units	43.95	1.98	0.61	15.66	5.70	67.90
BC stock (weight)	kg	2.00E+08	2.15E+09	5.62E+09	7.10E+08	1.92E+09	**1.06E+10**
Number of BC units (circuits) per building		3.9	0.2	0.2	1.4	2.2	

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Reasons

» Stock too high ?
» Energy consumption too high ? Load and load form factor.
» Average circuit length too low?
» Base case not representative (real versus virtual BC) ?
» Bug or wrong interpretation ?

» Solution
  » Extra checks (cross checks, method and tooling)
  » Extra base cases (virtual or real, extra circuit types, low loading, high loading…)
  » Validation of used data

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Data gaps / data validation

Dominic Ectors

Brussels, DG Enterprise
3rd of June 2014

Weight factors CSA

- Link to weightfactors.xlsx
  - Based upon ECI survey, 34 buildings (services & industry) in different countries
- Impact: relative importance of BC's
- GAP:
  - To cable manufacturers
  - sales information per section
    - per cable type, or for one cable type, or overall
    - if not possible in absolute figures, then relative factors (like the weight factors)

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BOM

- Filler material (amount and type of material)
- Cable types & insulation materials

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Validation of installation

- To installers and engineering companies
- Validation of circuit characteristics
  - table 3-2: CSA per circuit type (min/max)
  - table 3-4: average circuit length per circuit type (L)
  - table 3-7: number of nodes per circuit type (Kd factor)
  - commonly used cable types per circuit type
- Number of circuits (per circuit type) per building type and building floor area

Loading characteristics

- Measurements of existing electrical installations
  - Determination/verification of load factor and load form factor
  - Circuit breaker settings per circuit type and section ($I_{circuit}$)
- However, will be very different per installation, per circuit

Building info

- Used sources: BPIE, Ecofys study, Eurostat, MEErP (contradictions)
- Data:
  - Floor area per sector
  - Stock
  - Growth of stock (new & replacement / refurbishment)
  - % cable replacement when refurbishment
  - Number of buildings per sector
- Potential new sources:
  - Euroconstruct,...
- In combination with Cu/m^2 floor area -> Cu stock

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Industry sector

- Inside buildings versus outside
  - What is included (gray zone) in figures?
- Energy use
  - 1030 TWh according Eurostat (Industry sector)
- Floor area

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ANNEX M PRESENTATIONS 3RD STAKEHOLDER MEETING ON 13TH NOVEMBER 2014

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8- Power Cables

3rd stakeholder meeting

Paul Van Tichelen

Brussels, DG Enterprise
13 November 2014

Agenda

- 10:00-10:10 Welcome
- 10:10-10:20 Short presentation of participants
- 10:20:-11:20 Tasks 1-3 in a nutshell, incl. latest enquiry input
- 11:20-12:30 Task 4-6, based on updated input incl. improvement options and sensitivity analysis
- 12:30-13:30 Break & lunch
- 13:30-14:00 Draft Task 7 on policy options including discussion
- 14:00-14:20 Draft Task 7 on need for updated and/or new standards, including discussion
- 14:20-14:50 Draft Task 7 on 2025 scenarios
- 14:50-15:20 Draft Task 7 on impact including discussion and stakeholders position input
- 15:20-15:30 Any other business
- 15:30-15:40 Planning stakeholder feedback and finalization

EC policy officer & VITO Study Team

- EC policy officer: Cesar Santos
- VITO Preparotory Study Team:
  - Arnoud Lust: Contract Manager: Arnoud Lust (FC ENTR/29/PP/FC Lot 2) and FC DG ENER Lot 1
  - Main author power cables study&coordinator: Paul Van Tichelen
  - Co-authors:
    - Dominic Ectors (market and use data, ..)
    - Marcel Stevens (technical standards, ..)
    - Wai Chung Lam (LCA, MEErP and scenarios, ..)
  - Administrative contacts:
    - Magalie Wellens +32 14 33 58 04
    - Katrien Bultynck +32 14 33 59 96
  - Website: Karel Styns (webmaster).

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Introduction ErP Directive

- Background is the Ecodesign Directive 2009/125/EC:
  - Framework Directive
  - binding requirements through 'Implementing Measures' (EC Regulation ..)
  - For products but it is possible to introduce information requirements for components and sub-assemblies
  - Product groups are first identified in a Working Plan, such as power cables in the 2nd working plan year 2012-2014
  - **A preparatory study provides the necessary information to prepare for the next phases in the policy process, a.o.: impact assessment, the consultation forum, ..)**
  - Approach of preparatory study is well defined in the Methodology for the Ecodesign of Energy-related Products (MEErP)
  - Further info: http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm

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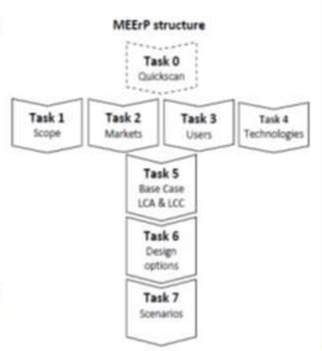
MEErP in a nutshell

- Tasks in MEErP (chapters in final report):
- Task 1 - Scope (definitions, standards and legislation, first screening);
- Task 2 – Markets (volumes and prices);
- Task 3 – Users (product demand side);
- Task 4 - Technologies (product supply side, includes both BAT and BNAT);
- Task 5 – Environment & Economics (Base case LCA & LCC);
- Task 6 – Design options;
- Task 7 – Scenarios (Policy, scenario, impact and sensitivit
- Tasks 1 to 4 can be performed in parallel



Planning

- 28 Jun 2013 ■Project kick-off meeting with EC
- July 2013 ■Launch website www.erp4cables.net
- Aug 2013 ■ Launch first series of enquiries to registered stakeholders
- 5 dec 2013 ■ 1st stakeholder meeting on Draft Task 1-3
- 3 June 2014 ■ 2nd stakeholder meeting on Draft Task 1-5
- **13 Nov 2014 ■ 3rd stakeholder meeting on Draft Task 1-7**
- End Feb 2015 ■ Publication Final Report Task 1-7

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 1

Paul Van Tichelen

Brussels, DG Enterprise
3rd of June2014

Task 1: Content

- "Product scope" of the study
- Product categories based on
  - Prodcom
  - EN- or ISO-standards
  - Other product-specific categories
- Definitions & Terminolgy
- Primary & secondary product performance parameters
- Product Standards & Legislation
  - EU level
  - Member state level
- First screening

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Task 1: Product scope

- **SCOPE: 'losses in installed power cables in electric circuits in buildings after the meter' taking into account the electrical installation as a system.**

  Out of the scope:
  - Losses in circuit breakers;
  - Losses or inefficiency in the loads connected to the circuit;
  - Losses due to poor connections ;
  - Utility cables for transmission (HV) and distribution (MV,LV) of electrical energy;
  - Power cables for Nuclear power;
  - Power cables for hazardous locations (in ATEX zones);
  - Cables used for power plants such as PV, Wind, ….;
  - Outdoor cables: Cables used in process installations (e.g. chemical and petrochemical plants), railway cables,..;
  - Cables for mobile applications: (electric) cars, ships, metro, …
  - Busbar Trunking systems;

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Task 1: Product performance parameter

- Primary product(cicuit) performance paramater or "Functional unit":
  - **Cable: "Current-Carrying capacity" of the cable/conductor [Amperes]**
  - **Circuit: > In: is rated current for the circuit and is determined by the protective device (safety fuses or circuit breakers) of the circuit;**
- Secondary:
  - CSA, LF, Kf, cos θ, L, ..

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Task 1: Measurement & test standards

- Conductors & cables
  - EN13601 & -13602: Copper and copper alloys
  - **EN 60228**: Conductors of insulated cables
    - Class1,2,5,6; Links **'Nominal CSA with Rdc max'**, ...
  - EN 50525-1: Low voltage energy cables
  - EN 50395: Electrical test methods for low voltage energy cables

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Task 1: Measurement & test standards

- Electrical installation:
  - **(IEC)HD 60364-5-52**: LV electrical installations – ... wiring systems
    - Correction factors, methods of installation, **dV max**, ...
  - IEC 60287-1-1: Calculation of current rating & losses -100% load factor
  - **IEC 60287-3-2**: Calculation of current rating – **Economic optimization single cable segment – not for distributed loads**
  - IEC 60364-6: Low Voltage electrical installations – verification
  - **IEC 60364-8-1 / FprHD 60364-8-1: 2013: Low voltage electrical installation - Part 8-1: Energy efficiency – DRAFT version:**
    - **Reduction of energy losses in wiring:**
      - **Reducing the voltage drop. Reference to IEC 60364-5-52;**
      - **Increasing the cross sectional area. Reference to IEC 60287-3-2;**
      - **Power factor correction to improve the power factor of the load circuit;**
      - **Reduction of harmonic currents at the load level.**
    - **Qualitative but not quantitative ?**

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Task 1: First screening

- **Note: these values are updated in later chapters!**
- Focus in taks 3-6 on service and industry sector

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 2

Paul Van Tichelen

Brussels, DG Enterprise
3rd of June 2014

Content

- » 2.1 Generic economic data
- » 2.2 Market and stock data
  - » 2.2.1 Sales data
  - » 2.2.2 Stock data
- » 2.3 Market trends
- » 2.4 Consumer expenditure base data
- » 2.5 Recommendations

Market and stock data: summary

Sector	Product life	Service life	Vacancy	Stock growth rate	Demolition rate	Replace-ment sales rate	New sales rate	Total sales rate	Stock (Reference year: 2010)	
Unit	Year	Year	%	% p.a.	% p.a.	% p.a.	% p.a.	% p.a.	kTon Cu	%
Residential sector	64.00	60.80	5%	0.90%	0.10%	1.18%	0.90%	2.08%	5241	43%
Services sector	25.00	23.75	5%	1.90%	0.20%	3.20%	1.90%	5.10%	3250	26%
Industry sector	25.00	23.75	5%	2.90%	0.20%	2.80%	2.90%	5.70%	3825	31%
Total sector (weighted)	41.60	39.52	5%	1.79%	0.16%	2.22%	1.79%	4.00%	12316	100%

Product/circuit cost

- Cost of circuit:
  - Cable cost (CSA [mm²] x l [m] x N) an average discounted cable price of 0.09434 €/ (mm². m).
  - Connector cost
  - Installation times per cable type
  - Average hourly rate (23,7 euro/h)

Minimum wire size	Maximum wire size	CSA	Connector price	Discounted connector price
mm^2	mm^2	mm^2	€	€
0.14	4	1	0.87	0.54
0.14	4	1.5	0.87	0.54
0.14	4	2.5	0.87	0.54
0.14	4	4	0.87	0.54
0.2	10	6	1.61	0.97
0.2	10	10	1.61	0.97
0.5	16	16	2.11	1.25
1.5	25	25	2.11	1.07
1.5	50	35	4.85	2.84
1.5	50	50	4.85	2.84
16	70	70	11.79	7.31
25	95	95	22.11	13.71
35	150	120	28.96	17.96
35	150	150	28.96	17.96
70	240	185	35.36	21.92
70	240	240	35.36	21.92
		300	44.20	27.40
		400	58.93	36.53
		500	73.67	45.67
		630	92.82	57.54

Cu based cables		
Section	Installation time per meter	Installation time for the cable ends
mm2	Min	Min
1	1.75	5
1.5	2.45	7
2.5	3.15	9
4	3.85	12
6	5.25	12
10	5.95	15
16	7	17
25	8.75	20.4
35	9.8	25.5
50	10.5	30.6
70	11.9	36
95	12.6	45
120	14	45
150	15.75	60
185	17.5	60
240	21	85
300	24.5	120
400	28	200
500	35	360
630	42	480

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Copper long-term availability

- Many comments received:
- Update needed, tekst added in 2.4.1 on 'purchase price' should fit in 2.4.1.1 'copper long term availability' (both will be integrated).
- Main change: copper is not considered as critical raw material, references added to other EU studies that focus in this topic, e.g.:
  - http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 3

Paul Van Tichelen

Brussels, DG Enterprise

3rd of June 2014

Task 3 Users

- **Systems aspects of the use phase for ErPs with direct impact**
  - Definition of the User and context
  - Loss parameters directly related to the cable itself
  - Other functional cable parameters not directly related to losses
  - Loss parameters directly related to the electrical circuit and network topology
  - Parameters related to the building and loading
  - Formulas used for power losses in cables
- **End of Life behaviour**
- **Local infrastructure (barriers & opportunities), e.g. cable bending**
- **Recommendations**

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CSA, parameter

Table 3—2: Minimum and maximum cable cross-sectional areas per circuit type

Sector	Circuit application type	CSA (mm^2) min	CSA (mm^2) max
Residential	Distribution circuit	6	16
	Lighting circuit	1	2.5
	Socket-outlet circuit	1.5	6
	Dedicated circuit	2.5	6
Services	Distribution circuit	10	600
	Lighting circuit	1.5	2.5
	Socket-outlet circuit	1.5	6
	Dedicated circuit	2.5	95
Industry	Distribution circuit	25	600
	Lighting circuit	1.5	2.5
	Socket-outlet circuit	1.5	10
	Dedicated circuit	2.5	600

Circuit length, parameter (from questionnaire)

Table 3—4: Average circuit length in meters according questionnaire[5]

Sector	Circuit application type	Average length min (m)	Average length ref (m)	Average length max (m)
Residential	Distribution circuit	15	21	54
	Lighting circuit	10	20	60
	Socket-outlet circuit	5	24	100
	Dedicated circuit	5	18	80
Services	Distribution circuit	20	56	200
	Lighting circuit	12	44	240
	Socket-outlet circuit	10	53	300
	Dedicated circuit	10	51	300
Industry	Distribution circuit	30	83	240
	Lighting circuit	20	68	340
	Socket-outlet circuit	15	72	500
	Dedicated circuit	15	79	400
CorrectionFactor		1	1	2

Load factors (α_c) and load form factors (Kf)

		Lighting circuit			Socket-outlet circuit			Dedicated circuit			Distribution circuit		
		Low	Ref	High	Low	Ref	High	Low	Ref	High	Low	Ref	High
Residential sector	Kf	3.12	2.11	1.67	4.38	1.74	1.34	4.61	3.99	3.12	1.24	1.14	1.08
	αc	0.01	0.05	0.10	0.00	0.04	0.10	0.01	0.02	0.05	0.01	0.06	0.22
	Kf . αc	0.03	0.11	0.17	0.01	0.06	0.13	0.02	0.08	0.14	0.02	0.07	0.23
Services sector	Kf	1.50	1.27	1.16	1.50	1.27	1.16	1.37	1.21	1.13	1.37	1.21	1.13
	αc	0.07	0.24	0.41	0.04	0.15	0.24	0.14	0.41	0.54	0.14	0.41	0.54
	Kf . αc	0.11	0.31	0.48	0.06	0.19	0.27	0.20	0.49	0.61	0.20	0.49	0.61
Industry sector	Kf	1.11	1.06	1.03	1.11	1.06	1.03	1.03	1.01	1.00	1.05	1.02	1.01
	αc	0.12	0.34	0.54	0.06	0.27	0.46	0.23	0.61	0.76	0.22	0.57	0.72
	Kf . αc	0.13	0.36	0.55	0.06	0.29	0.47	0.24	0.61	0.76	0.23	0.58	0.72
αc correction factor		0.5	1	1	0.5	1	1	0.5	1	1	0.5	1	1

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End of life parameters

» More info added on recycling
» source: kept similar with the MEErP default values also used in other ErP Ecodesigns studies

	Bulk Plastics	TecPlastics	Ferro	Non-ferro	Coating	Electronics	Misc. , excluding refrigant & Hg	refrigerant	Hg (mercury), **in mg/unit**	Extra	Auxiliaries
EoL mass fraction to re-use, in %	1%	1%	1%	0%	1%	1%	1%	1%	1%	1%	5%
EoL mass fraction to (materials) recycling, in %	29%	29%	94%	95%	94%	50%	64%	30%	39%	60%	30%
EoL mass fraction to (heat) recovery, in %	15%	15%		0%		0%	1%	0%	0%	0%	10%
EoL mass fraction to non-recov. incineration, in %	22%	22%		0%		30%	5%	5%	5%	10%	10%
EoL mass fraction to landfill/missing/fugitive, in %	33%	33%		5%		19%	29%	64%	55%	29%	45%

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Product life times

Sector	short product life		Reference		long product life	
	Replace-ment rate	Product life	Replace-ment rate	Product life	Replace-ment rate	Product life
Unit	%	year	%	year	%	year
Residential sector	2.10%	40	1.18%	64	0.80%	84
Services sector	7.08%	13	3.20%	25	1.70%	40
Industry sector	7.08%	12	2.80%	25	1.37%	40

Formula 3.5 used for power losses in cables

Ecircuit,(y) [kVAh] = Kd . Rt . Imax² . (αc . Kf)² . 8760 / 1000 (formula 3.5)

$$E_{circuit,(y)}\,[kVAh] = Kd \cdot Rt \cdot Imax^2 \cdot (\alpha c \cdot Kf)^2 \cdot 8760 / 1000 \quad \text{(formula 3.5)}$$

where,

- Kd = the distribution factor
- R_t = cable resistance at temperature t (see formula 3.2)
- Imax = the maximum rated current of the cable
- α_c = The corrected load factor (circuit level-distributed)
- Kf = Load form factor (=Prms/Pavg)
- PF = the power factor of the load served by the power cable

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 4

Dominic Ectors

Brussels, DG Enterprise
13 November 2014

Task 4: Technologies

- BAT
  - Product level (power cable)
  - System level (electrical installation/-circuit)
- BNAT
  - Product level (power cable)
  - System level (electrical installation/-circuit)
- Production, distrubition and End of Live (Task 3)
- Improvement options & recommendations

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Task 4: Technologies - BNAT

- BNAT at Product level (power cable)
  - ?
- BNAT at System level (electrical installation/-circuit)
  - Energy efficiency at appliance level
  - Building and home automation
  - Peak reduction control systems
  - DC power distribution in commercial buildings

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Task 4: Technologies - BNAT

- DC power distribution in commercial buildings, as for instance promoted by the EMerge Alliance.
- This system will use 380 VDC/24VDC instead of 110 or 230 VAC
- The rationale is that cable insulation is related to the peak voltage(Vpeak). In AC systems peak voltage is Vrms.√2 = 325 Vpeak. In DC systems the peak voltage is equivalent to the VDC. As a consequence an identical cable with identical insulation would need **less current in DC** (e;g.: 325VDC, 1A, 325 VA) compared to AC (e.g. 230 Vrms, 1.41A, 325 W) and will therefore reduce the cable losses.
- Such a switch from AC to DC is **complex** as it requires another concept of power distribution with different converters, protection switches, distribution transformers, etc. Therefore it will not be considered as a viable BAT improvement option.

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Task 4: Production, distribution and End of Live

- Section on Power Cable Manufacturing added
- Bill of Material Cu adapted
  - Using 5(4) cores (or 4 x 1 core)
  - Pricing based upon EURO/mm^2.m
- Bill of Material added for Al cable
- Cable composition added (from stakeholder)

Cable Part	Composition	% in weight
PVC sheath	PVC resin	45
	Ca Carbonate filler	25
	Plasticizer (DIDP)	25
	Lubricant, stabilizer and others	5
XLPE insulation	LDPE	97
	Crosslinking compound (Silane based)	3

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Task 4: Distribution

- Not changed

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Task 4: Improvement options & Recommendations

Option Name	Description
At cable level	
Low loss cable as a product	No BNAT technologies are available at cable level that could reduce the energy losses in an economical feasible manner. Labelling information on the cable about energy losses is not an improvement option and can be implemented by the scenarios mentioned in "at circuit level" part.
At circuit level (system level)	
S+x	Using, for a particular circuit and load, a cable with a larger CSA (S+x) than necessary (according current standards and regulation) will result in a lower cable resistance R, and thus lower energy losses. The CSA increments are conform the current, standardized CSA values (no new CSA values are considered).
2S	By installing, for a particular circuit and load, instead of one cable with a particular CSA_x one or more cables in parallel with the same CSA (or even smaller CSA than the original foreseen CSA_x) the losses in the circuit can be reduced.
Topology	Keeping the topology in mind when designing the electrical system of a building can reduce the energy losses in the circuits. For instance, to keep losses to a minimum, the main distribution transformers and switchboards are to be located to keep the distances (circuit lengths) to main loads to a minimum. The building's use, construction and space availability has to be taken into account to obtain the best position. One such method to determine the best position is the barycentre method[9].

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 5

Dominic Ectors

Brussels, DG Enterprise
13 November 2014

Task 5: aim

- **Task 5: Environment Economics**
  - Base Case Environmental Impact Assessment(EcoReport Tool)
  - Base Case Life Cycle Costs for consumer
  - Base Case Life Cycle Costs for society
  - EU wide impact

- to assess environmental and economic impacts of the different base cases.
- based upon EcoReport Tool version 3.06 , as provided with the MEErP 2011 methodology.

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Task 5 content (1)

- 5.1 Product-specific inputs
  - 5.1.1 Identification of base cases
  - 5.1.2 Manufacturing of the product: Bill Of Materials
  - 5.1.3 Distribution phase: volume of packaged product
  - 5.1.4 Use phase
  - 5.1.5 End of Life (EoL)
  - 5.1.6 Life Cycle Cost Inputs
- 5.2 Base case environmental impact assessment (using EcoReport)
- 5.3 Base case Life Cycle Cost for consumer
- 5.4 Base case Life Cycle Costs for society

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Task 5 content (2)

- 5.5 EU totals
  - 5.5.1 Stock specific inputs
  - 5.5.2 Environmental impact at EU-28
  - 5.5.3 Economic assessment at EU-28
- 5.6 Cross checks

5.1 Product-specific inputs
5.1.1 Identification of base cases

- Services sector
  - Base case 1: typical distribution circuit
  - Base case 2: typical lighting circuit
  - Base case 3: typical socket-outlet
  - Base case 4: typical dedicated circuit
- Industry sector
  - Base case 5: typical distribution circuit
  - Base case 6: typical lighting circuit
  - Base case 7: typical socket-outlet
  - Base case 8: typical dedicated circuit
- Industry sector
  - Base case 9: The same base case as base case 8, but instead of copper the cable conductors are of aluminium.

5.1.2 Bill Of Materials: base cases

- Conductor material: Cu or Al
- Insulation material: 100% LDPE (3% silane based crosslinking compound in the XLPE insulation, however due to the limited list of materials in the EcoReport tool 100% LDPE is used for the calculations)
- Sheath material, composed of:
  - 50% of the sheath material weight: PVC (not recycled);
  - 25% of the sheath material weight: talcum filler as filler material in the sheath (talcum filler in EcoReport tool instead of calcium carbonate)
  - 25% of the sheath material weight: bitumen (As it is the closest to a plasticizer in the EcoReport tool);
- Filler material: 100% talcum filler.

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5.1.2 Bill Of Materials: base cases

Table 5-3: Material resource input for base case 1

Pos nr	MATERIALS Extraction & Production Description of component	Weight in g	Category Click & select	Material or Process select Category first !
1	Conductor	600075.0	4- Non- ferro	30 - Cu wire
2	Insulation	268210	1- BlkPlastics	1- LDPE
3	Sheath - PVC	269317	1- BlkPlastics	8 - PVC
4	Sheath - Filler	13465.8	2- TecPlastics	18 - Talcum filler
5	Sheath - plasticizer	13465.8	7- Misc.	56 - Bitumen
6	Filler material	146340.7	2- TecPlastics	18 - Talcum filler

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5.1.3 Distribution phase: volume of packaged product

» Not changed, except there are 9 bases cases

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5.1.4 Use phase

Parameter	Unit	T	Base cases								
Base case id			BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
Sector			Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
Application circuit			Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
Loaded cores		I	6	2	2	3	12	2	2	3	3
Cables in parallel		I	2	1	1	1	4	1	1	1	1
Conductor material		I	Cu	Cu	Cu	Cu	Cu	Cu	Cu	Cu	Al
In per cable	A	I	289	10	16	62	451	10	16	156	156
CSA	mm^2	I	120	1.5	2.5	10	300	1.5	2.5	35	70
Length of circuit	m	I	56	44	53	51	83	68	72	79	79
ρ_t	Ω.m m^2/m	I	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0167	0.0265
R (formula 3.2) per wire	Ω	C	0.008	0.485	0.353	0.084	0.005	0.752	0.481	0.037	0.030
Kd		I	1.00	0.37	0.40	1.00	1.00	0.37	0.44	1.00	1.00
Kf		I	1.21	1.27	1.27	1.21	1.02	1.06	1.06	1.01	1.01
αc		I	0.41	0.24	0.15	0.41	0.57	0.34	0.27	0.61	0.61
Pf		I	0.80	1.00	0.80	0.80	0.80	1.00	0.80	0.80	0.80
Annual energy loss (formula 3.5) per loaded core	kWh	C	1392.06	15.22	10.81	694.00	2797.39	31.38	39.16	3011.51	2389.38
Annual energy loss (formula 3.5) per BC	kWh	C	8352.36	30.44	21.61	2082.01	33568.63	62.75	78.33	9034.54	7168.13
Annual energy transported (formula 3.6) per BC	kVAh	C	1,383,543	6,233	4,787	148,731	5,121,230	7,249	7,423	465,153	465,153
Energy loss ratio (formula 3.7)		C	0.60%	0.49%	0.45%	1.40%	0.66%	0.87%	1.06%	1.94%	1.54%

$E_{circuit,}(y)$ [kVAh] $= Kd . R_t . I_{circuit}^2 . (\alpha . Kf)^2 . 8760 / 1000$ (formula 3.5)

$E_{active}(y)$ [kWh] $= \sqrt{3} . V . I_{circuit} . \alpha . Kf . PF . 8760 / 1000$ (1-,3-phase) (formula 3.6)

Loss ratio = $E_{circuit}(y) / E_{active}(y)$ (formula 3.7)

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5.1.5 End of Life (EoL)

- Not changed compared to previous version
  - Defaults values of the EcoReport have been used for recycling rates of the materials
  - Only the re-use of metals is set to 0% instead of 1% and recycling of metals is set to 95% instead of 94% (see section 3.3 in Task 3)
- Remark Europacable: do not agree on 5% waste/landfill

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5.1.6 Life Cycle Cost Inputs

	Unit		Bases cases definiton								
Base case id			BC1	BC2	BC3			BC6	BC7	BC8	BC9
Sector			Services sector	Services sector	Services sector	sector	sector	Industry sector	Industry sector	Industry sector	Industry sector
Application circuit			Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
LCC data											
Year		I	2010	2010	2010	2010	2010	2010	2010	2010	2010
Electricity rate	€/kWh	I	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Product price for 1 meter cable	€	I	56.60	0.71	1.18	4.72	113.21	0.71	1.18	16.51	18.79
Price connectors	€	I	359.20	35.59	24.87	15.54	876.80	40.94	18.07	43.25	111.31
Bace case product price	€	C	6727.15	66.41	87.11	254.01	38235.44	88.70	102.97	1339.24	1586.41
Base case installation cost	€	I	693.23	78.65	98.45	137.78	3572.78	107.30	113.40	334.55	391.53
Product life	Year	I	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Product service life	Year	I	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75

To be checked

Product life 25 instead of 14 years

Added connector cost, per node

Cost per meter + ends (per node)

Discounted product prices excl. VAT, based upon EURO/mm^2.m

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5.2 BASE CASE ENVIRONMENTAL IMPACT ASSESSMENT (USING ECOREPORT)

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EcoReport tool: input summary

Is split up in different components in EcoReport tool

Table 5-8: EcoReport tool input parameters per base case

	Unit	Base cases: ecoreport input								
Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
CSA	mm²	120	1.5	2.5	10	300	1.5	2.5	35	70
Conductor material	g	600075.0	2904.1	5864.9	22471.9	3520440.0	4500.6	8001.0	122126.4	74182.5
Insulation material	g	26821.0	935.3	1349.2	2223.0	147862.8	1449.5	1840.7	7.8	14.9
Sheath material	g	53863.3	3458.1	4673.7	6561.1	270615.7	5359.1	6376.0	16512.0	31330.4
Filler material	g	146340.7	1794.8	2652.4	7140.9	638181.6	2781.4	3618.4	30692.3	66196.7
Annual energy loss (formula 3.5) per BC	kWh	8352.36	30.44	21.61	2082.01	33568.63	62.75	78.33	9034.54	7168.13
Volume	m3	0.93	0.02	0.02	0.04	5.17	0.02	0.03	0.18	0.39
Product life	Year	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Product service life	Year	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75	23.75
Bace case product price	€	6727.15	66.41	87.11	254.01	38235.44	88.70	102.97	1339.24	1586.41
Annual sales (base case units)	mln. Units	0.13	2.86	3.77	0.98	0.03	1.78	2.00	0.24	0.24
EU Stock (base case units)	mln. Units	3.23	71.43	94.32	24.62	0.71	44.44	49.99	5.94	5.94
Base case installation cost	€	693.23	78.65	98.45	137.78	3572.78	107.30	113.40	334.55	391.53
Electricity rate	€/kWh	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
EoL mass fraction to re-use, non-Ferro material	%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Conductor material		Cu	Cu	Cu	Cu	Cu	Cu	Cu	Cu	Al

Added

Including connector cost

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5.3 BASE CASE LIFE CYCLE COST FOR CONSUMER

Base Case Life Cycle Cost for consumer

Table 5-18: Life Cycle Costs for consumer per base case

	Unit	Life Cycle Costs per base case								
Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
Product price	€	6727.15	66.41	87.11	254.01	38235.44	88.70	102.97	1339.24	1586.41
Installation/ acquisition costs (if any)	€	693.23	78.65	98.45	137.78	3572.78	107.30	113.40	334.55	391.53
Electricity	€	22968.99	83.72	59.43	5725.54	92313.73	172.57	215.40	24845.00	19712.35
Total	€	30389.36	228.78	244.99	6117.33	134121.95	368.57	431.77	26518.79	21690.29
Product price	%	22%	29%	36%	4%	29%	24%	24%	5%	7%
Installation/ acquisition costs (if any)	%	2%	34%	40%	2%	3%	29%	26%	1%	2%
Electricity	%	76%	37%	24%	94%	69%	47%	50%	94%	91%
Total	%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Including connector cost

Cost per meter + ends (per node)

Running costs discounted to their Net Present Value

5.5 EU TOTALS

EU totals: stock specific input

Table 5-20: Stock input parameters per base case

	Unit					Bases cases definiton					
Base case id			BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
Sector			Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
Application circuit			Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
Stock and sales data (fixed total stock)											
Year			2010	2010	2010	2010	2010	2010	2010	2010	2010
EU Stock per base case cable (Conductor weight)	kg	I	1.94E+09	2.07E+08	5.53E+08	5.53E+08	2.50E+09	2.00E+08	4.00E+08	7.25E+08	4.40E+08
EU Stock (units of 1 cable)	m	C	3.63E+08	3.11E+09	4.98E+09	1.24E+09	2.34E+08	3.00E+09	3.60E+09	4.66E+08	4.66E+08
EU Stock (base case units)	mln. Units	C	1.75	38.82	51.26	13.38	0.39	24.15	27.17	3.23	3.23
Annual sales (base case units)	mln. Units	C	0.07	1.55	2.05	0.54	0.02	0.97	1.09	0.13	0.13
BC weightfactor of total stock		I	14.00%	1.50%	4.00%	4.00%	50.00%	4.00%	8.00%	14.50%	

three reference parameters had to be corrected to fit EU-28 stock and EU-28 electricity consumption: see cross-checks

Environmental impact at EU-28 (annual)

Table 5-21: EU-28 total annual environmental impacts from the installed stock

	Unit	Environmental									
Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9	Total (BC1-BC8)
Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector	
Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit	
Materials											
Plastics	Mt	0.028	0.015	0.029	0.014	0.028	0.015	0.021	0.010	0.022	0.16
Ferrous metals	Mt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Non-ferrous metals	Mt	0.078	0.008	0.022	0.022	0.101	0.008	0.016	0.029	0.018	0.29
Other resources & waste											
Total Energy (GER)	PJ	71.80	7.41	9.94	119.13	67.59	8.64	12.64	124.82	100.65	421.96
of which, electricity	TWh	6.82	0.60	0.61	12.86	6.05	0.75	1.05	13.44	10.70	42.16
Water (process)*	mln.m3	0.07	0.08	0.15	0.06	0.08	0.08	0.11	0.03	0.06	0.67
Waste, non-haz./ landfill*	Mt	0.04	0.01	0.01	0.06	0.03	0.01	0.01	0.06	0.06	0.22
Waste, hazardous/ incinerated*	kton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Emissions (Air)											
Greenhouse Gases in GWP100	mt CO2eq.	3.17	0.33	0.46	5.12	3.02	0.38	0.57	5.37	4.35	18.43
Acidifying agents (AP)	kt SO2eq.	34.76	3.70	7.98	28.57	40.12	3.85	6.80	31.53	19.63	157.29
Volatile Org. Compounds (VOC)	kt	1.37	0.13	0.14	2.59	1.22	0.16	0.23	2.70	2.16	8.55
Persistent Org. Pollutants (POP)	g i-Teq.	0.44	0.04	0.10	0.35	0.50	0.05	0.08	0.39	0.31	1.95
Heavy Metals (HM)	ton Ni eq.	4.94	0.54	1.33	2.42	6.13	0.54	1.02	2.85	1.05	19.76
PAHs	ton Ni eq.	0.58	0.07	0.15	0.40	0.69	0.07	0.12	0.45	1.96	2.53
Particulate Matter (PM, dust)	kt	1.39	0.88	1.59	1.13	1.57	0.85	1.17	0.99	1.53	9.56
Emissions (Water)											
Heavy Metals (HM)	ton Hg/20	7.64	0.84	2.17	2.62	9.76	0.81	1.59	3.29	1.05	28.72
Eutrophication (EP)	kt PO4	0.03	0.00	0.01	0.03	0.03	0.01	0.01	0.03	0.02	0.14

42 TWh, including production, distribution, use and EoL phase.

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Economic assessment at EU-28 (annual)

Table 5-22: Total annual expenditure in the EU-28 per base case

	Unit	Total annual expenditure in the EU-28 per base case									Total (BC1-BC8
Base case id	0	BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9	
Sector	0	Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector	
Application circuit	0	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit	
Product price	mln. €	847.05	143.33	285.81	243.13	1074.73	124.44	189.43	313.33	364.64	3221.25
Installation/ acquisition costs (if any)	mln. €	85.28	177.12	314.98	127.14	96.57	156.67	205.04	76.12	88.51	1238.92
Electricity	mln. €	741.11	59.81	56.06	1409.45	655.56	76.69	107.69	1474.92	1170.22	4581.27
Total	mln. €	1673.44	380.25	656.85	1779.73	1826.85	357.80	502.15	1864.36	1623.37	9041.43
Product price	%	26%	4%	9%	8%	33%	4%	6%	10%	11%	100%
Installation/ acquisition costs (if any)	%	7%	14%	25%	10%	8%	13%	17%	6%	7%	100%
Electricity	%	16%	1%	1%	31%	14%	2%	2%	32%	26%	100%
Total	%	19%	4%	7%	20%	20%	4%	6%	21%	18%	100%

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5.6 CROSS CHECKS

Cross-checks: correction

- the outcome for the losses were too high.
- The bases cases as such, although abstract cases, are not representative for the average total stock and losses in Europe.
- Therefore corrections factors. With the fitted parameters the total energy transported by the base cases equals the energy consumed at EU level, and the stock equals the stock figures in Task 3.
- Three reference parameters are corrected:
  - The reference circuit length (Task 3) is multiplied by 1.84;
  - The reference load factor (Task 3) is multiplied by 0.5;
  - The weight distribution towards the circuits (Task 2) is altered (see Table 5-20).

Cross-checks: correction

» Potentially a lot of circuits in the stock have a relative lower loading and/or longer circuit length and/or higher share of bases case with lower loading. This is also something taken into account in the sensitivity analysis (Task 6).

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Cross checks: fixed stock (sales, lifetime)

Table 5-23: EU-28 totals check: first method

	Unit	T	Base cases								Total over all BC
Base case id			BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	
Sector			Services	Services	Services	Services	Industry	Industry	Industry	Industry	
Application circuit			Distribution	Lighting	Socket-	Dedicated	Distribution	Lighting	Socket-	Dedicated	
Method 1: fixed stock	**kg**	**I**									**7.08E+09**
Energy distribution factor	%	I	100%	20%	20%	60%	100%	10%	15%	75%	
EU Stock (base case units)	mln. Units	I	1.75	38.82	51.26	13.38	0.39	24.15	27.17	3.23	
Number of buildings per sector (Task 2 Table 2-9)	mln Units	I	11.41	11.41	11.41	11.41	2.58	2.58	2.58	2.58	
Annual energy loss (formula 3.5) per BC	kWh	I	3842.09	14.00	9.94	957.73	15441.57	28.87	36.03	4155.89	
Annual energy transported (formula 3.6) per BC	kVAh	I	691,772	3,117	2,394	74,365	2,560,615	3,625	3,712	232,577	
Checks											
Annual energy loss Eu-28 (=BC loss * #BC units)	TWh	C	6.74	0.54	0.51	12.81	5.96	0.70	0.98	13.41	34.91
Annual energy transported Eu-28 (=BC annual energy transport * #BC units)	TWh	C	1,213	121	123	995	988	88	101	750	
Annual energy transported Eu-28 corrected with energy distribution factor	TWh	C	1,213	605	614	1,658	988	875	672	1,000	
Number of BC units (circuits) per building		C	0.2	3.4	4.5	1.2	0.1	9.4	10.5	1.3	

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Cross checks: fixed EU-28 electricity consumption

Table 5-24: EU-28 totals check: second method

	Unit		Base cases								Total over all BC
Base case id			BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	
Sector			Services	Services	Services	Services	Industry	Industry	Industry	Industry	
Application circuit			Distribution	Lighting	Socket-	Dedicated	Distribution	Lighting	Socket-	Dedicated	
Method 2: fixed EU-28 energy consumption	TWh	I	904				1030				1934
Energy distribution factor	%	I	100%	20%	20%	60%	100%	10%	15%	75%	
Number of buildings per sector (Task 2 Table 2-9)	mln Units	I	11.41	11.41	11.41	11.41	2.58	2.58	2.58	2.58	
Annual energy transported (formula 3.6) per BC	kVAh	I	691,772	3,117	2,394	74,365	2,560,615	3,625	3,712	232,577	
EU28 energy consumption (distributed via energy distribution factor)	TWh	C	904.12	180.82	180.82	542.47	1029.62	102.96	154.44	772.21	1933.74
Checks											
Annual energy loss Eu-28 (=BC loss * #BC units)	TWh	C	5.02	0.81	0.75	6.99	6.21	0.82	1.50	13.80	35.90
BC stock (= EU-28 energy consumption / energy transported per BC)	mln Units	C	1.31	58.02	75.54	7.29	0.40	28.41	41.61	3.32	215.90
BC stock (weight)	kTon	C	1443.07	310.02	815.24	301.62	2604.63	235.22	612.56	746.10	7068.48

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 6 - design options

Dominic Ectors

Brussels, DG Enterprise
13 November 2014

6.1 Identification of design options and assessment of their impacts

Table 6-1: Design options

Design option	Description		Unit	T	Base cases definiton								
		Base case id			BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
		Sector			Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
		Application circuit			Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
		Parameter											
BAU	Business As Usual	CSA	mm^2	I	120	1.5	2.5	10	300	1.5	2.5	35	70
D1	S+1	CSA	mm^2	I	150	2.5	4	16	400	2.5	4	50	95
D2	S+2	CSA	mm^2	I	185	4	6	25	500	4	6	70	120
D3	S+3	CSA	mm^2	I	240	6	10	35	630	6	10	95	150
D4	2S	Cables in parallel multiplicator		I	2	2	2	2	2	2	2	2	2

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6.2 Improvement of Ecoreport Impact indicators

» 6.2.1 Impact per parameter

Table 6-3: Electricity

		Unit	of which, electricity (in primary MJ)								
	Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
	Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
	Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
BAU	of which, electricity (in primary MJ)	MJ	1791182	6668	4845	445443	7202865	13662	17050	1932280	1534557
D1	of which, electricity (in primary MJ)	MJ	1435369	4091	3161	278676	5412938	8336	10838	1352990	1131613
D2	of which, electricity (in primary MJ)	MJ	1167395	2667	2255	178767	4323256	5381	7426	967408	897418
D3	of which, electricity (in primary MJ)	MJ	904406	1899	1586	128076	3438519	3775	4774	714232	718966
D4	of which, electricity (in primary MJ)	MJ	904390	3575	2761	223341	3642788	7204	8987	967858	770833
D1	Versus BAU	%	-20%	-39%	-35%	-37%	-25%	-39%	-36%	-30%	-26%
D2		%	-35%	-60%	-53%	-60%	-40%	-61%	-56%	-50%	-42%
D3		%	-50%	-72%	-67%	-71%	-52%	-72%	-72%	-63%	-53%
D4		%	-50%	-46%	-43%	-50%	-49%	-47%	-47%	-50%	-50%

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Impact (GWP)

Table 6-7: Greenhouse Gases in GWP100

		Unit	Greenhouse Gases in GWP100								
	Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
	Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
	Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
BAU	Greenhouse Gases in GWP100	kg CO2 eq.	79307	318	257	19145	323619	630	793	83067	66202
D1	Greenhouse Gases in GWP100	kg CO2 eq.	64811	217	203	12088	252258	417	552	58554	49201
D2	Greenhouse Gases in GWP100	kg CO2 eq.	54234	171	187	7921	209279	314	438	42424	39463
D3	Greenhouse Gases in GWP100	kg CO2 eq.	44283	157	203	5859	177825	275	385	32031	32088
D4	Greenhouse Gases in GWP100	kg CO2 eq.	44292	210	209	9785	187796	392	505	42475	34289
D1	Versus BAU	%	-18%	-32%	-21%	-37%	-22%	-34%	-30%	-30%	-26%
D2		%	-32%	-46%	-27%	-59%	-35%	-50%	-45%	-49%	-40%
D3		%	-44%	-50%	-21%	-69%	-45%	-56%	-51%	-61%	-52%
D4		%	-44%	-34%	-18%	-49%	-42%	-38%	-36%	-49%	-48%

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Impact (Heavy metals)

Table 6-11: Heavy Metals to air

		Unit	Heavy Metals								
	Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
	Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
	Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
BAU	Heavy Metals	mg Ni eq.	39033	178	264	5299	195517	307	464	23809	15736
D1	Heavy Metals	mg Ni eq.	40661	220	371	4082	218338	358	570	19779	11734
D2	Heavy Metals	mg Ni eq.	44042	307	525	3776	248225	486	758	18313	9440
D3	Heavy Metals	mg Ni eq.	50959	435	845	4046	292396	679	1178	18789	7721
D4	Heavy Metals	mg Ni eq.	50984	253	453	3842	282202	406	669	18324	8229
D1	Versus BAU	%	4%	23%	40%	-23%	12%	17%	23%	-17%	-25%
D2		%	13%	72%	99%	-29%	27%	58%	63%	-23%	-40%
D3		%	31%	144%	220%	-24%	50%	121%	154%	-21%	-51%
D4		%	31%	42%	71%	-27%	44%	32%	44%	-23%	-48%

Circuits with a low load factor have relatively a high increase of heavy metals

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Impact (GWP) per life cycle phase, relative

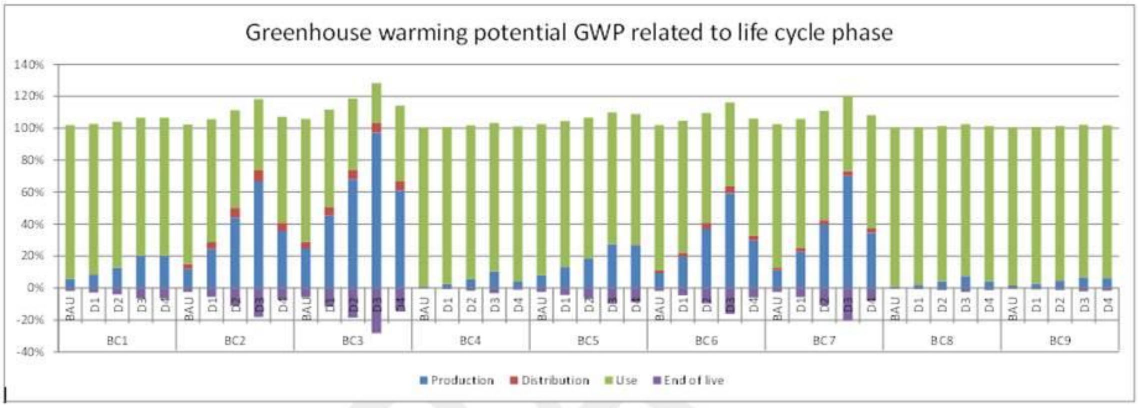

Figure 6-1 Greenhouse Gases (in detail, each phase relative to total) in GWP100

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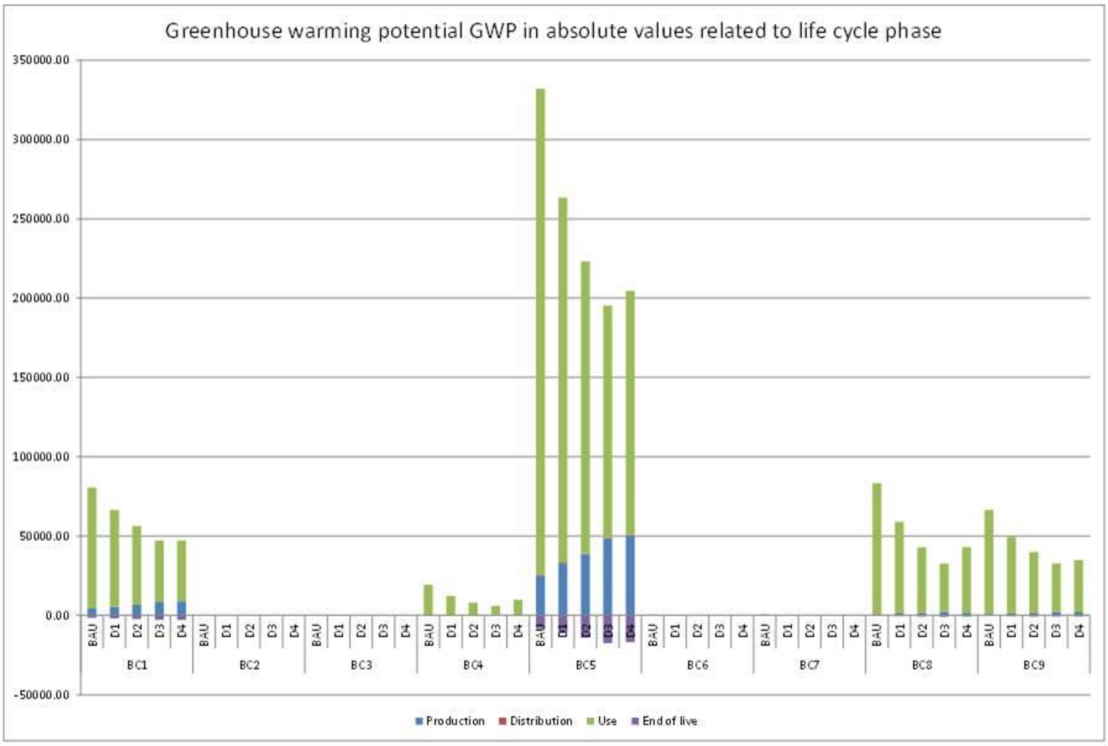

Figure 6-2 Greenhouse Gases in absolute values (in detail, each phase relative to total) in GWP100

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Greenhouse gas: Environmental payback period

Table 6-19: Greenhouse Gases: environmental payback period in years

	Unit	Greenhouse Gases: payback period								
Base case id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
Product lifetime	years	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
D1	years	1.80	3.45	9.61	0.35	2.59	2.59	3.61	0.34	0.46
D2	years	2.30	5.58	14.07	0.56	2.76	4.20	5.28	0.52	0.66
D3	years	2.94	8.24	23.07	0.76	3.67	6.19	8.64	0.73	0.79
D4	years	2.95	7.00	16.71	0.51	4.17	5.26	6.27	0.55	0.83

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6.2.3 Conclusion on EcoReport tool impact parameters

Table 6-20: best performing design option per parameter and base case

	Best performing design option per parameter and base case								
Base case id	BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
Sector	Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
Application circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
Other resources and waiste									
Total Energy (GER)	D3	D3	D2	D3	D3	D3	D3	D3	D3
of which, electricity (in primary MJ)	D4	D3	D3	D3	D3	D3	D3	D3	D3
Water (process)	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
Waste, non-haz./ landfill	D3	D3	D2	D3	D3	D3	D3	D3	D3
Emissions (air)									
Waste, hazardous/ incinerated	D3	D3	D3	D3	D3	D3	D3	D3	D3
Greenhouse Gases in GWP100	D3	D3	D2	D3	D3	D3	D3	D3	D3
Acidification, emissions	D2	D1	BAU	D3	D1	D1	D1	D3	D3
Volatile Organic Compounds (VOC)	D3	D3	D3	D3	D3	D3	D3	D3	D3
Persistent Organic Pollutants (POP)	D2	D1	BAU	D3	D1	D1	D1	D3	D3
Heavy Metals	BAU	BAU	BAU	D2	BAU	BAU	BAU	D2	D3
PAHs	D1	BAU	BAU	D3	D1	D1	BAU	D3	BAU
Particulate Matter (PM, dust)	BAU	BAU	BAU	D3	BAU	BAU	BAU	D3	D1
Emissions (water)									
Heavy Metals	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	D3
Eutrophication	D3	D1	BAU	D3	D2	D1	D1	D3	D3

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6.3 Impact on Life Cycle Cost

		Unit	Life Cycle Costs per base case per year								
	Base case id		BC1	BC2	BC3	BC4	BC5	BC6			
	Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Indust secto			
	Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
BAU	Product price	€	6727.15	66.41	87.11	254.01	38235.44	88.70	102.97	1339.24	1586.41
	Installation cost	€	698.23	78.65	98.45	137.78	3572.78	107.30	113.40	334.55	391.53
	Electricity cost	€	22968.99	83.72	59.43	5725.54	92313.73	172.57	215.40	24845.00	19712.35
	Total	€	30389.36	228.78	244.99	6117.33	134121.95	368.57	431.77	26518.79	21690.29
D1	Product price	€	8319.14	86.96	124.45	401.55	50980.59	120.54	153.92	1894.67	2210.69
	Installation cost	€	794.69	101.12	123.98	161.27	4281.80	137.96	141.25	362.39	422.59
	Electricity cost	€	18375.19	50.23	37.15	3578.46	69235.30	103.54	134.62	17391.50	14524.89
	Total	€	27489.02	238.31	285.57	4141.29	124497.69	362.04	429.79	19648.56	17158.17
	Purchase price compared to BAU		+23%	+30%	+34%	+44%	+32%	+32%	+36%	+35%	+33%
	Total cost compared to BAU		-10%	+4%	+17%	-32%	-7%	-2%	-0%	-26%	-21%
	SPP	years	9.22	32.11	70.52	1.99	14.57	22.63	24.39	1.96	3.16
D2	Product price	€	10255.66	117.77	194.15	613.30	63725.73	168.30	236.31	2703.30	2802.23
	Installation cost	€	872.46	128.81	153.16	200.52	6225.20	174.61	181.07	412.30	463.83
	Electricity cost	€	14898.80	31.40	24.76	2290.22	55388.24	64.71	89.75	12422.50	11498.87
	Total	€	26026.91	277.98	372.07	3104.03	125339.17	407.62	507.12	15538.10	14764.93
	Purchase price compared to BAU		+50%	+70%	+87%	+108%	+67%	+75%	+93%	+86%	+65%
	Total cost compared to BAU		-14%	+22%	+52%	-49%	-7%	+11%	+17%	-41%	-32%
	SPP	years	11.49	48.50	116.64	3.07	19.05	34.05	39.99	2.90	3.92
D3	Product price	€	13174.30	187.38	295.73	880.09	80294.42	264.75	372.16	3726.47	3434.42
	Installation cost	€	1067.49	152.89	178.68	227.93	7773.60	211.94	208.92	444.83	532.44
	Electricity cost	€	11484.49	20.93	14.86	1635.87	43958.92	43.14	53.85	9153.42	9199.10
	Total	€	25726.28	361.19	487.27	2743.89	132026.94	519.84	634.92	13324.72	13165.95
	Purchase price compared to BAU		+92%	+135%	+159%	+183%	+111%	+143%	+169%	+149%	+101%
	Total cost compared to BAU		-15%	+58%	+99%	-55%	-2%	+41%	+47%	-50%	-39%
	SPP	years	14.85	77.72	160.89	4.38	23.92	54.22	56.44	3.98	4.73
D4	Product price	€	13454.30	132.82	174.21	508.02	76470.88	177.39	205.95	2678.48	3172.83
	Installation cost	€	1386.45	157.30	196.91	275.56	7145.55	214.60	226.81	669.10	783.05
	Electricity cost	€	11484.49	41.86	29.72	2862.77	46156.87	86.28	107.70	12422.50	9856.17
	Total	€	26325.24	331.98	400.84	3646.34	129773.30	478.28	540.45	15770.08	13812.06
	Purchase price compared to BAU		+100%	+100%	+100%	+100%	+100%	+100%	+100%	+100%	+100%
	Total cost compared to BAU						-3%	+30%	+25%	-41%	-36%
	SPP						22.64	56.79	50.23	3.37	5.02

Very low Simple Payback Period (SPP)

Very high Simple Payback Period (SPP)

6.4 Analysis of BAT and LLCC

Table 6-22: LLCC and BAT per base case

		Unit	Base cases								
	Base case Id		BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8	BC9
	Sector		Services sector	Services sector	Services sector	Services sector	Industry sector	Industry sector	Industry sector	Industry sector	Industry sector
	Application circuit		Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Distribution circuit	Lighting circuit	Socket-outlet circuit	Dedicated circuit	Dedicated circuit
BAU	Total Energy (GER)	MJ	1844983	7289	5803	447921	7509255	14563	18316	1943151	1547287
D1	Total Energy (GER)	MJ	1502325	4900	4464	282332	5815923	9530	12574	1367955	1148097
D2	Total Energy (GER)	MJ	1250532	3760	3990	184289	4800293	7015	9753	988460	918571
D3	Total Energy (GER)	MJ	1011499	3351	4168	135517	4036890	5964	8255	742897	744630
D4	Total Energy (GER)	MJ	1011881	4706	4566	228186	4255457	8896	11408	989490	796183
BAU	LCC	€	30389.36	228.78	244.99	6117.33	134121.95	368.57	431.77	26518.79	21690.29
D1	LCC	€	27489.02	238.31	285.57	4141.29	124497.69	362.04	429.79	19648.56	17158.17
D2	LCC	€	26026.91	277.98	372.07	3104.03	125339.17	407.62	507.12	15538.10	14764.93
D3	LCC	€	25726.28	361.19	487.27	2743.89	132026.94	519.84	634.92	13324.72	13165.95
D4	LCC	€	26325.24	331.98	400.84	3646.34	129773.30	478.28	540.45	15770.08	13812.06
BAT			D3	D3	D2	D3	D3	D3	D3	D3	D3
LLCC			D3	BAU	BAU	D3	D1	D1	D1	D3	D3

6.5 Long term potential (BNAT) & systems analysis

- 380 VDC systems replacing 230 VAC

6.6 Sensitivity analysis

- **6.6.1 Sensitivity to circuit loading**
  - the load factor;
  - load form factor;
  - Kd factor;
  - number of nodes per circuit.
- **6.6.2 Sensitivity to length of the circuits**
- **6.6.3 Sensitivity to product lifetime**

6.6.1 Sensitivity to circuit loading

Table 6-32: design option sensitivity to circuit use (load)

	BAT - load sensitivity			LLCC - load sensitivity		
	low	ref	high	low	ref	high
BC1	D3	D3	D3	BAU	D3	D3
BC2	D1	D3	D3	BAU	BAU	D1
BC3	BAU	D2	D3	BAU	BAU	BAU
BC4	D3	D3	D3	D1	D3	D3
BC5	D3	D3	D3	BAU	D1	D4
BC6	D2	D3	D3	BAU	D1	D1
BC7	BAU	D3	D3	BAU	D1	D1
BC8	D3	D3	D3	D1	D3	D3
BC9	D3	D3	D3	D1	D3	D3

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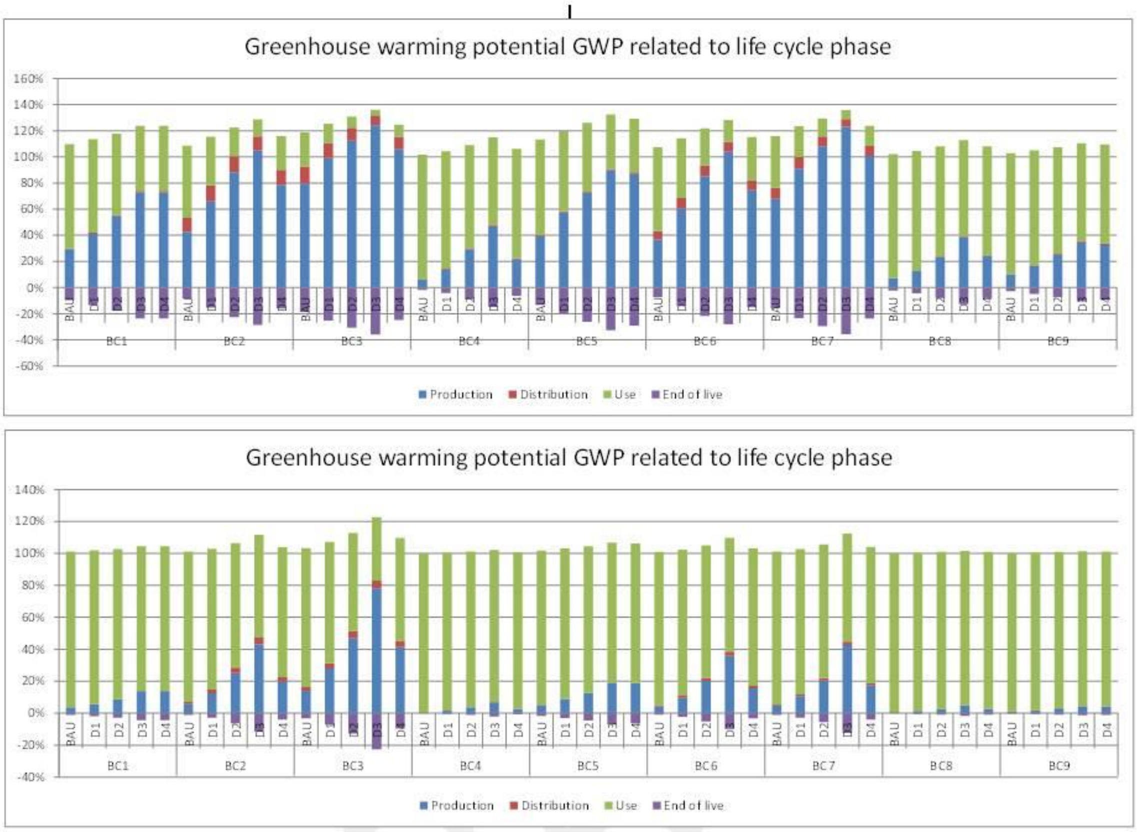

Figure 6-23 Greenhouse Gases (in detail, relative of each phase to total) in GWP100 for the 'high values'

6.6.2 Sensitivity to length of the circuits

Table 6-42: design option sensitivity to circuit length

	BAT - length sensitivity			LLCC - length sensitivity		
	low	ref	high	low	ref	high
BC1	D3	D3	D3	D3	D3	D3
BC2	D3	D3	D3	BAU	BAU	BAU
BC3	D2	D2	D2	BAU	BAU	BAU
BC4	D3	D3	D3	D3	D3	D3
BC5	D3	D3	D3	D1	D1	D1
BC6	D3	D3	D3	BAU	D1	D1
BC7	D3	D3	D3	BAU	D1	D1
BC8	D3	D3	D3	D3	D3	D3
BC9	D3	D3	D3	D3	D3	D3

6.6.3 Sensitivity to product lifetime

Table 6-43: Life time parameters per sector

	short product life		Reference		long product life	
Sector	Replace-ment rate	Product life	Replace-ment rate	Product life	Replace-ment rate	Product life
Unit	%	year	%	year	%	year
Residential sector	2.10%	40	1.18%	64	0.80%	84
Services sector	7.08%	13	3.20%	25	1.70%	40
Industry sector	7.08%	12	2.80%	25	1.37%	40

6.6.3 Sensitivity to product lifetime

Table 6-53: Design option sensitivity to product lifetime

	BAT - lifetime sensitivity			LLCC - lifetime sensitivity		
	low	ref	high	low	ref	high
BC1	D3	D3	D3	D1	D3	D3
BC2	D3	D3	D3	BAU	BAU	D1
BC3	D1	D2	D3	BAU	BAU	BAU
BC4	D3	D3	D3	D3	D3	D3
BC5	D3	D3	D3	BAU	D1	D4
BC6	D3	D3	D3	BAU	D1	D1
BC7	D3	D3	D3	BAU	D1	D1
BC8	D3	D3	D3	D3	D3	D3
BC9	D3	D3	D3	D3	D3	D3

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Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8-Power Cables

Stakeholder meeting: Task 7 - scenarios

Paul Van Tichelen - Dominic Ectors

Brussels, DG Enterprise

13 November 2014

Task 7 structure

- » **Stakeholders position – to be provided**
- » Policy options
- » Scenarios
- » Socio-economic Impact
- » Sensitivity analysis

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Policy options- at product level?

- » generic ecodesign requirements on information? (increase awareness
  - » E.g. maximum DC ohmic resistance per kilometer at 20°C
  - » E.g. on websites and/or packages:
    - » Cable losses per kilometer @ 50, 100 % load
    - » Tracking data of real measured ohmic resistance? (quality control data)
- » Scope:
  - » IEC 60502-1: Power cables with extruded insulation and their accessories for rated voltages from 1kV up to 30 kV. Remark: restricted to cables with a rated voltage U0/U (Um) of 0.6/1 (1.2kV)
  - » EN 50525-1 Electric cables: LV energy cables of rated voltages up to and including 450/750 (U0/u) Remark: restricted to EN50525 cables for fixed wiring

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Policy option at product level and/or circuit level

- Are electrical circuits in building products?
  - No? > elements or components of a building and so far were not considered as 'products' in European legislation
  - not satisfy the minimum volume of sales requirement of article 15 (5) of the ErP regulation (2009/125/EC
  - cannot be moved or relocated and the 'free movement of goods' is therefore irrelevant
  - Currently don't belong to the product categories of the CE product marking directive (93/68/EEC).
- Therefore other policy proposals are included

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Policy options at circuit/installation level - scope

- Scope
  - "installed Low Voltage power cables in buildings after the meter"
    - Suggest to focus, e.g.:
      - circuits between the transformer(s) and the main distribution board of the building, after the meter;
      - Electric circuits between the main distribution board and the secondary distribution boards;
      - Dedicated electric circuits from the main and secondary distribution boards to electrical consumers with a high load factor (large number of operating hours per year) (e.g. HVAC components and servers).

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Policy options – Specific requirements to increase CSA

- Require LCC (economic optimisation)
  - IEC 60287-3-2 Electric cables – Calculation of the current – part 3-2: sections on operating conditions – Economic optimization of power cable size?
  - Web tool or software tool?
  - Introduction of an extra correction factor based on the load factor of the electric consumer. HD 60364-5-52:2011 (IEC 60364-5-52:2009) defines two correction factors to determine the maximum allowable current-carrying capacity of an electric circuit (apart from method of installation & ambient temperature)?
  - Inclusion in the EPB Directive (2010/31/EU)?
    - updated prIEC 60364-8-1 (EE in electrical installations), updatedEN15603, and a new standard EN15XXX?

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Policy options – Generic requirements to increase CSA

- Before installation:
  - Information: ref., the design current (Ib), rated current of the circuit (In), L, estimated load factor, Kf or equivalent hours of peak load?
  - Note: updated prIEC 60364-8-1? Align with IEC 60287-3-2 on economic optimization method?
- After installation:
  - Measure & indicate resistance
  - Add label with parameters
  - Note: updated prIEC 60364-8-1?
- In BACS (Building Automation and Control Systems)
  - the load factor (LF) and load form factor (Kf) and/or equivalent or equivalent time of peak load
  - include monitoring functions in standard EN 15232 (2007)?

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7.2 .1 Scenario definition

Scenario	BC1	BC2	BC3	BC4	BC5	BC6	BC7	BC8
BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
BAT	D3	D3	D2	D3	D3	D3	D3	D3
LLCC	D3	BAU	BAU	D3	D1	D1	D1	D3
IV	D1	BAU	BAU	D1	D1	BAU	BAU	D1

- Circuits are not products !!!
- Scenarios **not** based upon ecodesign measures !!!!!
- Gives an indication if **all** circuits in services and industry are considered
- ‘Improved’ circuits replace BAU circuits at replacement rate (product life)
- Correction factors in T5 are used! Meaning low load, long circuits.

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7.2.2.1 Main input parameters for the analysis

Discount rate	4.0%
Inflation rate	2.0%
Energy Escalation rate	4.0%
Electricity rate (€/kWh)	0.11
Stock growth rate services sector	1.9%
Stock growth rate industry sector	2.9%
Sales growth rate services sector	3.2%
Sales growth rate industry sector	2.8%
Product lifetime services sector (years)	25
Product lifetime industry sector (years)	25

Table 7-5: Main input parameters

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7.2.2.2 Stock

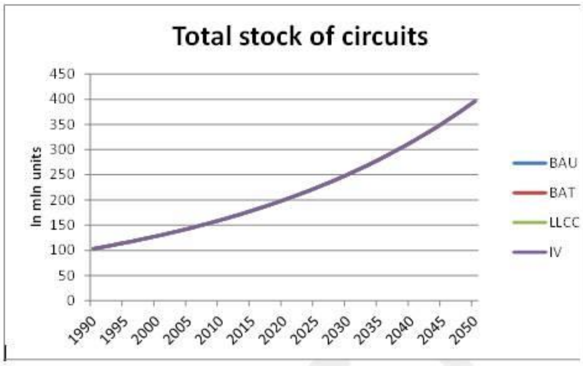

Figure 7-1: Total stock of circuits (in circuit units)

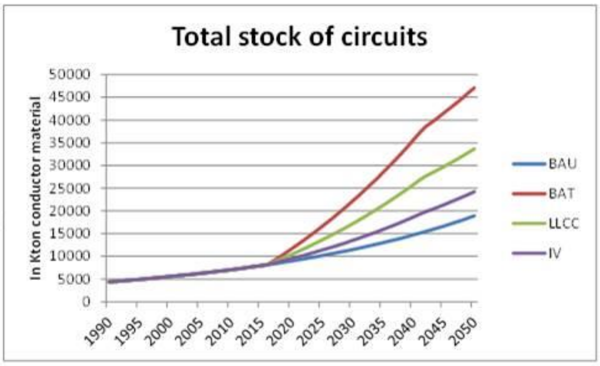

Figure 7-2: Total stock of circuits (in Kton conductor material)

Eurostat EU electricity consumption

Table 2-12 EU28 annual final consumption of electricity by industry and households/services in TWh[16]

	Final annual energy consumption in TWh											
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Industry	1075	1081	1089	1120	1133	1131	1142	1119	966	1030	1037	1008
Households	744	753	787	798	806	818	810	820	820	845	803	828
Services	703	716	741	763	780	822	837	864	867	904	885	898

-0,74% annual growth rate in the industry

+2,0 up to +2,5% annual growth rate in services

» In this model is:

electricity consumption growth = stock growth

=> Stock growth for industry: 0% ??

7.2.2.3 Annual sales of circuits

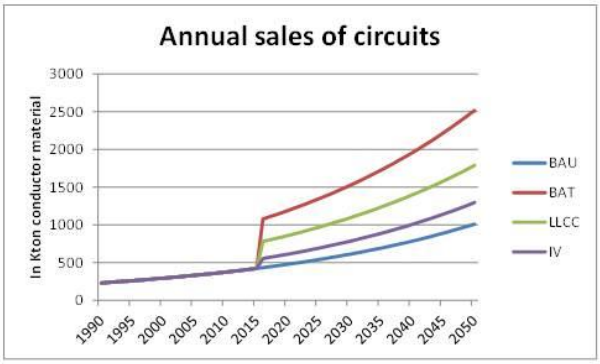

Figure 7-8: Annual sales of circuits (in Kton conductor material)

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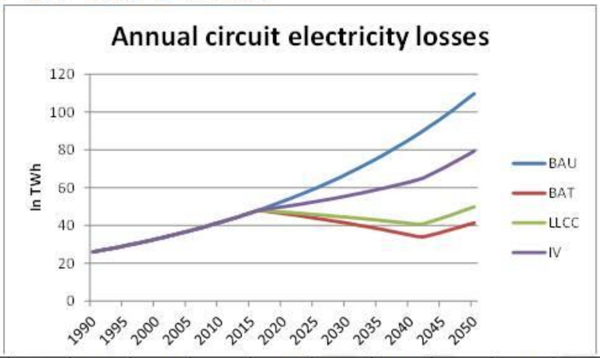
7.2.2.4 Annual demand of electricity due to losses in circuits



	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BAU	26.02	29.24	32.88	36.99	41.65	46.91	52.88	59.64	67.30	75.99	85.85	97.05	109.77
BAT	26.02	29.24	32.88	36.99	41.65	46.91	46.30	43.89	41.20	38.20	34.86	36.55	41.38
LLCC	26.02	29.24	32.88	36.99	41.65	46.91	47.08	45.77	44.33	42.77	41.06	44.01	49.92
IV	26.02	29.24	32.88	36.99	41.65	46.91	49.95	52.62	55.68	59.17	63.17	70.17	79.42
Absolute difference to BAU													
BAT	0.00	0.00	0.00	0.00	0.00	0.00	-6.58	-15.75	-26.10	-37.79	-50.99	-60.50	-68.39
LLCC	0.00	0.00	0.00	0.00	0.00	0.00	-5.80	-13.87	-22.97	-33.22	-44.79	-53.04	-59.86
IV	0.00	0.00	0.00	0.00	0.00	0.00	-2.93	-7.02	-11.62	-16.82	-22.68	-26.88	-30.36
Relative difference to BAU													
BAT	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-12.4%	-26.4%	-38.8%	-49.7%	-59.4%	-62.3%	-62.3%
LLCC	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-11.0%	-23.3%	-34.1%	-43.7%	-52.2%	-54.6%	-54.5%
IV	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-5.5%	-11.8%	-17.3%	-22.1%	-26.4%	-27.7%	-27.7%

Table 7-16: Annual circuit electricity losses (in TWh/yr)

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7.2.2.5 Annual emissions of CO_2 eq.

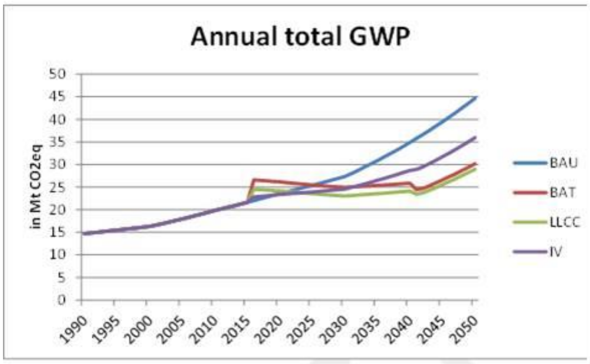

Figure 7-15: Annual total GWP (in Mt CO_2 eq.)

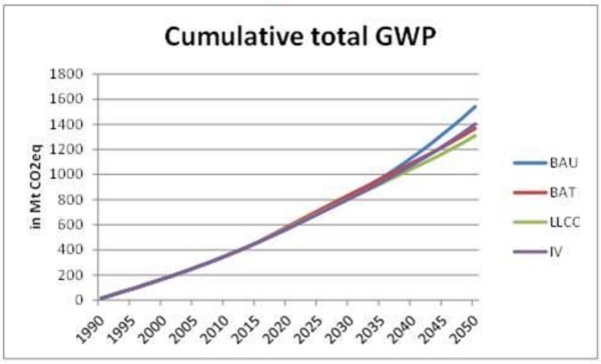

Figure 7-16: Cumulative GWP (in Mt CO_2 eq.)

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BAU	14.71	90.66	170.57	256.99	352.30	456.74	570.69	694.07	826.89	974.06	1140.33	1328.32	1540.96
BAT	14.71	90.66	170.57	256.99	352.30	456.74	588.64	717.36	843.14	969.17	1097.53	1224.59	1368.11
LLCC	14.71	90.66	170.57	256.99	352.30	456.74	578.51	697.48	813.72	930.48	1049.99	1171.98	1309.81
IV	14.71	90.66	170.57	256.99	352.30	456.74	572.31	690.86	812.42	940.99	1080.03	1231.31	1402.38
Absolute difference to BAU													
BAT	0.00	0.00	0.00	0.00	0.00	0.00	17.96	23.29	16.25	-4.89	-42.80	-103.73	-172.85
LLCC	0.00	0.00	0.00	0.00	0.00	0.00	7.82	3.41	-13.17	-43.57	-90.34	-156.34	-231.15
IV	0.00	0.00	0.00	0.00	0.00	0.00	1.62	-3.20	-14.47	-33.06	-60.30	-97.01	-138.59
Relative difference to BAU													
BAT	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+3.1%	+3.4%	+2.0%	-0.5%	-3.8%	-7.8%	-11.2%
LLCC	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+1.4%	+0.5%	-1.6%	-4.5%	-7.9%	-11.8%	-15.0%
IV	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.3%	-0.5%	-1.8%	-3.4%	-5.3%	-7.3%	-9.0%

Table 7-21: Cumulative GWP (in Mt CO_2 eq.)

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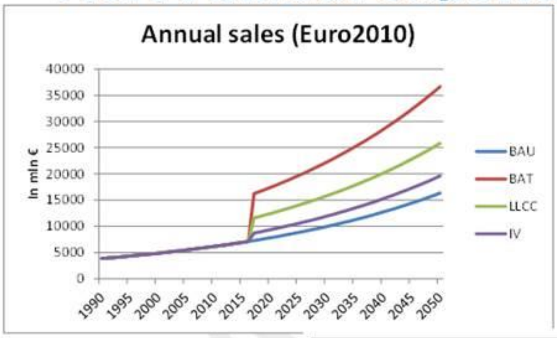
7.3 Socio-economic impact analysis

7.3.1 Annual expenditure



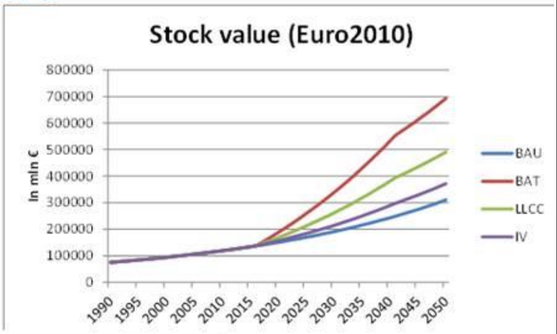


Figure 7-17: Annual sal

Stock value (in mln. euro)

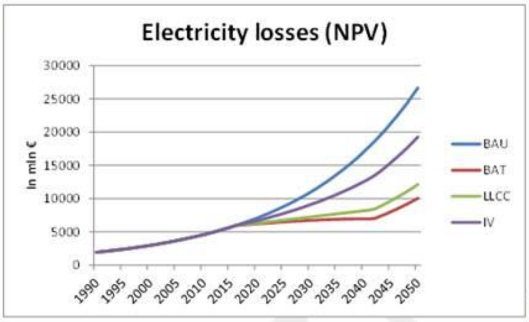


Figure 7-19: Annual expenditure due to electricity losses (in mln. euro)

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7.3.2 Impact on workforce

- can lead to significant job creation within EU28 in the sector of local electrical contracting, local engineering.
- Stakeholders: please provide input and figures if possible

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7.3.3 Any other relevant impact ?

- Impact on the market structure, size of the companies, role and responsibility ...

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7.4 Sensitivity analysis
7.4.1 sensitivity case 1

Discount rate	4.0%
Inflation rate	2.0%
Energy Escalation rate	4.0%
Electricity rate (€/kWh)	0.11
Stock growth rate services sector	1.0%
Stock growth rate industry sector	1.0%
Sales growth rate services sector	1.7%
Sales growth rate industry sector	1.4%
Product lifetime services sector (years)	40
Product lifetime industry sector (years)	40

Table 7-25: Sensitivity case 1 - Main input parameters

7.4.1.1 Stock

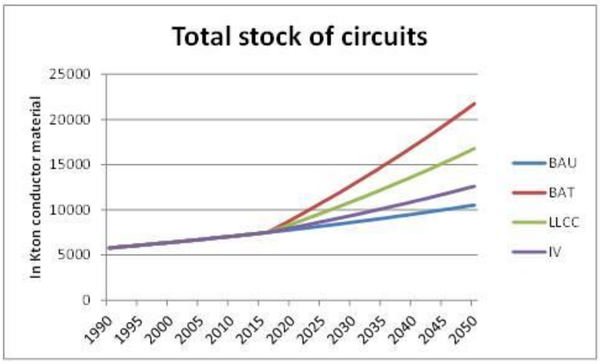
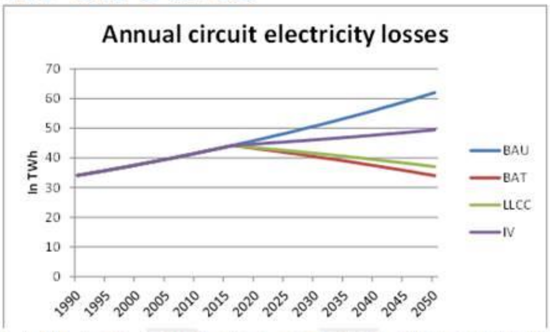


Figure 7-21: Sensitivity case 1 - Total stock of circuits (in Kton conductor material)

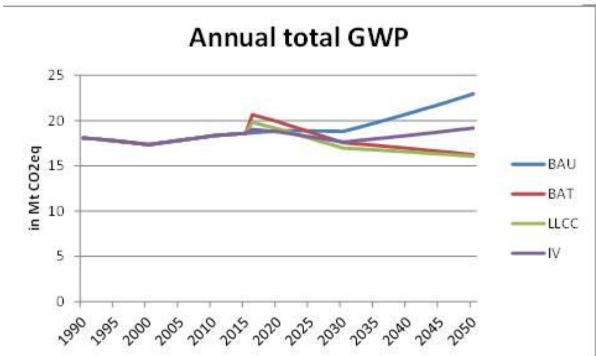
7.4.1.3 Annual demand of electricity due to losses in circuits



	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BAU	34.13	35.87	37.70	39.63	41.65	43.77	46.01	48.35	50.82	53.41	56.14	59.00	62.01
BAT	34.13	35.87	37.70	39.63	41.65	43.77	43.18	41.84	40.42	38.94	37.38	35.74	34.02
LLCC	34.13	35.87	37.70	39.63	41.65	43.77	43.49	42.55	41.56	40.52	39.43	38.28	37.07
IV	34.13	35.87	37.70	39.63	41.65	43.77	44.74	45.43	46.16	46.92	47.72	48.57	49.45
Absolute difference to BAU													
BAT	0.00	0.00	0.00	0.00	0.00	0.00	-2.82	-6.51	-10.39	-14.47	-18.76	-23.26	-27.99
LLCC	0.00	0.00	0.00	0.00	0.00	0.00	-2.52	-5.80	-9.26	-12.89	-16.71	-20.72	-24.94
IV	0.00	0.00	0.00	0.00	0.00	0.00	-1.27	-2.92	-4.66	-6.49	-8.41	-10.43	-12.56
Relative difference to BAU													
BAT	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-6.1%	-13.5%	-20.5%	-27.1%	-33.4%	-39.4%	-45.1%
LLCC	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-5.5%	-12.0%	-18.2%	-24.1%	-29.8%	-35.1%	-40.2%
IV	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-2.8%	-6.0%	-9.2%	-12.2%	-15.0%	-17.7%	-20.2%

Table 7-36: Sensitivity case 1 - Annual circuit electricity losses (in TWh/yr)

GWP



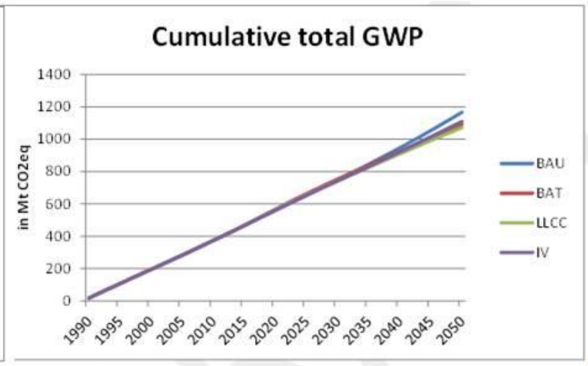


Figure 7-34: Sensitivity case 1 - Annu

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BAU	18.09	107.57	195.15	283.32	373.96	466.42	560.22	654.53	748.67	845.54	947.34	1054.35	1166.81
BAT	18.09	107.57	195.15	283.32	373.96	466.42	567.72	663.53	753.61	840.51	925.82	1009.45	1091.31
LLCC	18.09	107.57	195.15	283.32	373.96	466.42	563.63	655.83	742.73	826.92	910.03	992.01	1072.80
IV	18.09	107.57	195.15	283.32	373.96	466.42	560.84	652.95	742.24	831.46	922.52	1015.53	1110.57
Absolute difference to BAU													
BAT	0.00	0.00	0.00	0.00	0.00	0.00	7.50	9.01	4.94	-5.02	-21.53	-44.90	-75.50
LLCC	0.00	0.00	0.00	0.00	0.00	0.00	3.41	1.31	-5.93	-18.61	-37.31	-62.34	-94.01
IV	0.00	0.00	0.00	0.00	0.00	0.00	0.63	-1.58	-6.43	-14.08	-24.82	-38.82	-56.24
Relative difference to BAU													
BAT	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+1.3%	+1.4%	+0.7%	-0.6%	-2.3%	-4.3%	-6.5%
LLCC	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.6%	+0.2%	-0.8%	-2.2%	-3.9%	-5.9%	-8.1%
IV	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.1%	-0.2%	-0.9%	-1.7%	-2.6%	-3.7%	-4.8%

Table 7-41: Sensitivity case 1 - Cumulative GWP (in Mt CO_2 eq.)

7.4.2 sensitivity case 2

Discount rate	2.5%
Inflation rate	1.0%
Energy Escalation rate	4.0%
Electricity rate (€/kWh)	0.11
Stock growth rate services sector	1.9%
Stock growth rate industry sector	2.9%
Sales growth rate services sector	3.2%
Sales growth rate industry sector	2.8%
Product lifetime services sector (years)	25
Product lifetime industry sector (years)	25

Table 7-45: Sensitivity case 2 - Main input parameters

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7.4.2.1 *Annual expenditure due to electricity losses*

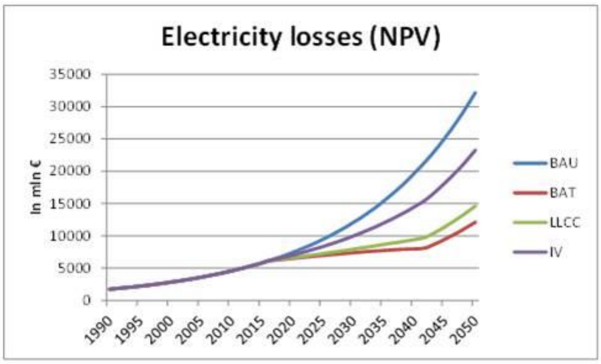

Figure 7-41: Sensitivity case 2 - Annual expenditure due to electricity losses (in mln. euro)

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7.4.3 sensitivity case 3

Discount rate	4.0%
Inflation rate	2.0%
Energy Escalation rate	1.0%
Electricity rate (€/kWh)	0.11
Stock growth rate services sector	1.9%
Stock growth rate industry sector	2.9%
Sales growth rate services sector	3.2%
Sales growth rate industry sector	2.8%
Product lifetime services sector (years)	25
Product lifetime industry sector (years)	25

Table 7-49: Sensitivity case 3 - Main input parameters

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7.4.3 Annual expenditure due to electricity losses

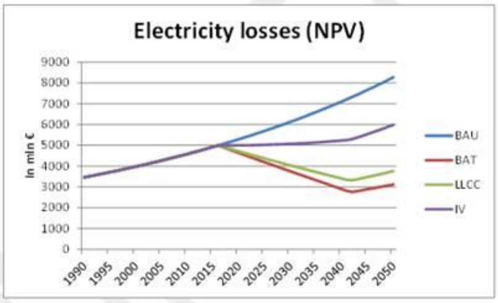

Figure 7-42: Sensitivity case 3 - Annual expenditure due to electricity losses (in mln.

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
BAU	3458.97	3707.40	3976.03	4266.66	4581.27	4922.00	5291.23	5691.54	6125.75	6596.98	7108.62	7664.40	8268.39
BAT	3458.97	3707.40	3976.03	4266.66	4581.27	4922.00	4632.92	4188.65	3750.34	3316.64	2886.19	2886.53	3117.06
LLCC	3458.97	3707.40	3976.03	4266.66	4581.27	4922.00	4710.84	4367.70	4035.23	3712.78	3399.70	3475.88	3759.89
IV	3458.97	3707.40	3976.03	4266.66	4581.27	4922.00	4997.75	5021.88	5067.88	5136.91	5230.31	5541.47	5981.73
Absolute difference to BAU													
BAT	0.00	0.00	0.00	0.00	0.00	0.00	-658.32	-1502.89	-2375.42	-3280.35	-4222.43	-4777.86	-5151.33
LLCC	0.00	0.00	0.00	0.00	0.00	0.00	-580.40	-1323.84	-2090.52	-2884.20	-3708.92	-4188.51	-4508.50
IV	0.00	0.00	0.00	0.00	0.00	0.00	-293.49	-669.66	-1057.87	-1460.07	-1878.31	-2122.93	-2286.66
Relative difference to BAU													
BAT	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-12.4%	-26.4%	-38.8%	-49.7%	-59.4%	-62.3%	-62.3%
LLCC	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-11.0%	-23.3%	-34.1%	-43.7%	-52.2%	-54.6%	-54.5%
IV	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	-5.5%	-11.8%	-17.3%	-22.1%	-26.4%	-27.7%	-27.7%

Table 7-50: Sensitivity case 3 - Annual expenditure due to electricity losses (in mln. euro)